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On Analysing Anaemia using Fuzzy Matrices

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Abstract. Anaemia is a common health problem among women throughout the world. In order to know the health condition of village people and to know the people who are affected by anaemia. A survey was made among 250 women in Punavasal village, Tiruvarur district. In this paper, we obtain the maximum age group of women affected by anaemia are found by using fuzzy matrices and some useful suggestions and concluding remarks are provided.

Keywords: Anaemia, fatigue, dizziness, shortness of breath, cramp in legs, ATD matrix, RTD matrix, CETD matrix

AMS Mathematics Subject Classification (2010): 15B15

1. Introduction

In 1998, Fuzzy matrix theory was developed by Vasantha and Indira to study the passenger transportation. To study this problem, they divided and defined four types of matrices are called Initial Raw Data Matrix, Average Time Dependent Data matrix (ATD Matrix), Refined Time Dependent Data matrix (RTD Matrix) and Combined Effect Time Dependent Data Matrix (CETD Matrix). In the year 2007, the same technique was used by Kandasamy. Elumalai et al. [1] study the Social and Psychological problems faced by RAG pickers. In 2008, Devadoss et al. [3] estimate the maximum age group of the Bhutanese having conjunctivitis problem using this model. Now we use this model to find the peak age group of women affected by Anaemia.

Anaemia happens when a person doesn't have enough red blood cells. If there is no enough red blood cells in the blood, blood can't carry enough oxygen to the body and it causes anaemia. About 30% of the world population is anaemic. Most cases of anaemia are mild and easily treated. However, severe or long-lasting anaemia can damage the heart, brain and organs of the body. It may even cause death. According to the District level Health Survey (DLHS-2013-14), 49.2% of women are anaemic between 15-49 years in Tamil Nadu. According to UNICEF, anaemia levels in rural Tamil Nadu are 49.7% while it is 48.8% in urban areas. In this paper an attempt is made to find out the peak age of a women getting anaemia in Punavasal village, Tiruvarur district.Whatman Filter Paper method is used for the study. We have collected the data from the village among 250 women. The symptoms of anaemia namely fatigue, dizziness, shortness of breath, muscle cramps in legs are identified. The raw data which we obtained is transformed into time dependent matrices such as ATD matrix, RTD matrix and CETD

matrix. Using these concepts we identify the peak age group of the people suffering from anaemia and also give the graphical representation. This paper is organized as follows. In section 2, some basic definitions of fuzzy matrices are given. In section 3, description of the problem is proposed and some suggestions and conclusions are given in section 4.

2. Preliminaries

2.1. Average time dependent (ATD) matrix

Raw data is transformed into a raw time dependent data matrix by taking along the rows the details of the age group and along the columns the number of occurrences of different symptoms. The Average Time Dependent Data (ATD) matrix (a_{ij}) is obtained by dividing each entry of the raw data matrix by the number of years i.e., the time period. We find the average and Standard Deviation (S.D) of every column in the ATD matrix.

2.2. Refined time dependent (RTD) matrix

Using the average $\mu_j$of each j^{th}column and $\sigma_j$the S.D of the each j^{th}column we chose a parameter α from the interval [0,1] and form the interval [0,1] and form the Refined time dependent Matrix (RTD matrix), Using the formula

$a_{ij} \leq (\mu_j$-α*$\sigma_j)$ then e_{ij}=-1

elseIf $a_{ij} \epsilon (\mu_j$-α*σ_j, μ_j+α*$\sigma_j)$then e_{ij}=0

else If $a_{ij} \geq (\mu_j$-α*$\sigma_j)$ then e_{ij}=1

We redefine the ATD matrix into the Refined time dependent fuzzy matrix for here the entries are = 0 or 1. Now the row sum of this matrix gives the maximum age group.

2.3. Combined effective time dependent data (CETD) matrix

We also combine the above RTD matrices by varying the αϵ[0,1], so that we get the Combined Effective Time Dependent Data(CETD) matrix. The row sum is obtained for CETD matrix and certain results are derived based on the row sums. All these are represented by graphs and graphs play a vital role in exhibiting the data by the simplest means, which a layman can understand.

3. Description of the problem

We have collected data from 250 women in the village of Punavasal, Tiruvarur district for finding the maximum age group of women affected by anaemia. The symptoms of Anaemia are fatigue, dizziness, shortness of breath, muscle cramps in legs. We analyze these problems using fuzzy matrix, we call the RTD Matrix is fuzzified by the entries from the set {-1,0,1}. In this paper, the symptoms of Anaemia which are taken as the columns of the initial row data matrix the age group in years,5-15,15-25,25-35,35-45,45-55&55-65.. The estimation of the maximum age group is five-stage process. In the first stage we give the matrix representation of the raw data. The 6 x 4 matrix is not uniform i.e. the number of individual years in each interval may not be the same. So in the second stage, in order to obtain an unbiased uniform effect on each and every data so collected, transform this initial matrix into an Average Time Dependent Data (ATD) matrix. To make the calculations easier and simpler, in the third stage using the simple average techniques convert the above average time dependent data matrix in to a matrix with

entries $e_{ij}\epsilon$\{-1,0,1\}. We name this matrix as the Refined Time Dependent Data Matrix (RTD Matrix) or as the fuzzy matrix. The value of corresponding to each entry is determined in a special way. At the fourth stage using the fuzzy matrices we obtain the Combined Effect Time Dependent Data Matrix (CETD Matrix), which gives the cumulative effect of all these entries. In the final stage we obtain the row sums of the CETD matrix. The graph of the RTD matrix and CETD matrix are given.

3.1. Estimation of maximum age group of anaemia by using 6x4 matrices

In this section we take four attributes related to symptoms of anaemia namely - s_1 −Fatigue, s_2 −dizziness, s_3 −shortness in breath, s_4 −cramps in legs.

The initial raw data matrix of order 6x4.

years	s_1	s_2	s_3	s_4
5-15	6	4	3	1
15-25	8	6	5	2
25-35	9	8	8	6
35-45	8	9	7	4
45-55	8	5	6	7
55-65	7	8	8	9

The ATD Matrix of order 6x4

Years	s_1	s_2	s_3	s_4
5-15	0.6	0.4	0.3	0.1
15-25	0.8	0.6	0.5	0.2
25-35	0.9	0.8	0.8	0.6
35-45	0.8	0.9	0.7	0.4
45-55	0.8	0.5	0.6	0.7
55-65	0.7	0.8	0.8	0.9

The average and standard deviation of the above ATD matrix

Average	0.7667	0.6667	0.1617	0.4833
S.D	0.1033	0.6867	0.1941	0.3061

Interval at α=0.1	0.7563	0.6471	0.1423	0.4527
	0.7770	0.6867	0.1811	0.5139
α=0.Type equation here.15	0.7512	0.6373	0.1326	0.4374
	0.7852	0.6961	0.1908	0.5292
α=0.2	0.7460	0.6275	0.1223	0.4221
	.7874	0.7060	0.2005	0.5445

The RTD matrix for α=0.1

$$\begin{pmatrix} -1 & -1 & 1 & -1 \\ 1 & 0 & 1 & -1 \\ 1 & 1 & 1 & 1 \\ 1 & 1 & -1 & 0 \\ 0 & -1 & 1 & 1 \\ 0 & 1 & -1 & 1 \end{pmatrix}$$

The row sum matrix

$$\begin{pmatrix} -2 \\ 1 \\ 4 \\ 1 \\ 1 \\ 1 \end{pmatrix}$$

The RTD matrix for α=0.15

$$\begin{pmatrix} -1 & -1 & 1 & -1 \\ 0 & -1 & 1 & -1 \\ 1 & 1 & 1 & 1 \\ 0 & 1 & 1 & -1 \\ 0 & 0 & 1 & 1 \\ -1 & 1 & 1 & 1 \end{pmatrix}$$

The row sum matrix

$$\begin{pmatrix} -2 \\ -1 \\ 4 \\ 1 \\ 2 \\ 2 \end{pmatrix}$$

The RTD matrix for α=0.15

$$\begin{pmatrix} 0 & -1 & 1 & -1 \\ -1 & -1 & 1 & -1 \\ 1 & 1 & 1 & 1 \\ -1 & -1 & -1 & -1 \\ -1 & 1 & 1 & -1 \\ 1 & 0 & 1 & 1 \end{pmatrix}$$

The row sum matrix

$$\begin{pmatrix} -1 \\ -4 \\ 4 \\ -4 \\ 0 \\ 3 \end{pmatrix}$$

The graph depicting the maximum age group of women for the parameter α=0.1

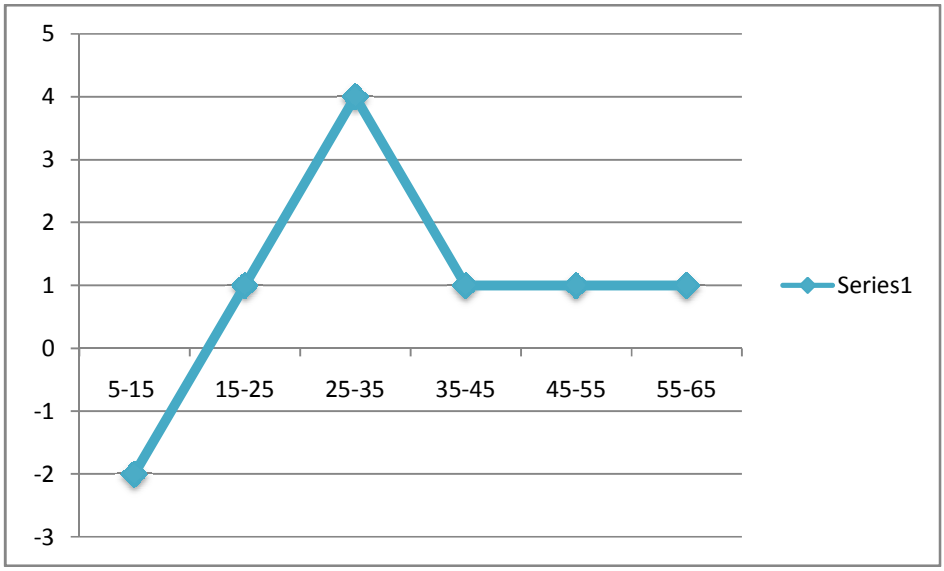

Figure 1: Women at the age group of 25-35 years having Anaemia

The graph depicting the maximum age group of women for the parameter α=0.15

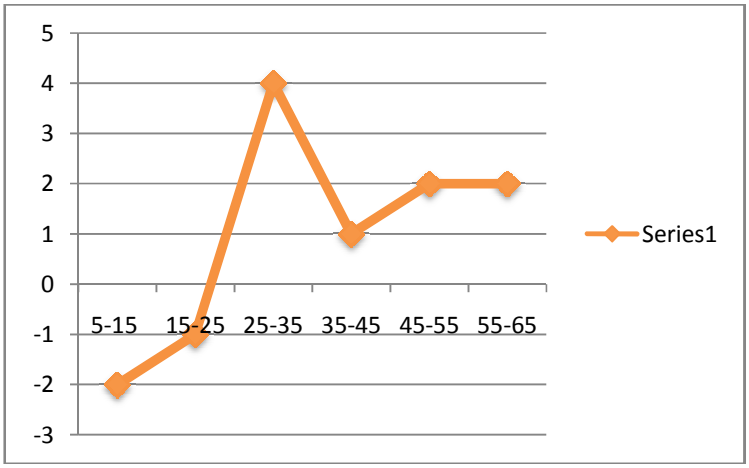

Figure 2: Women at the age group of 25-35 years having Anaemia

The graph depicting the maximum age group of women for the parameter $\alpha=0.2$

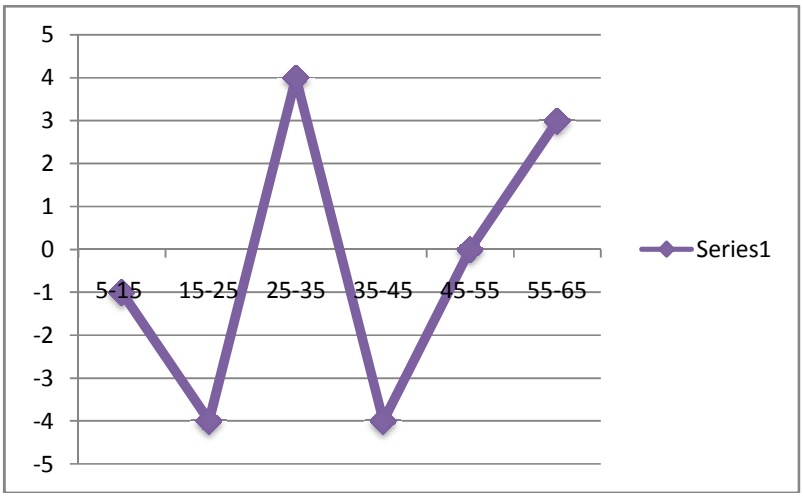

Figure 3: Women at the age group of 25-35 years having Anaemia

The CETD matrix

$$\begin{pmatrix} -2 & -3 & 1 & -3 \\ 0 & -2 & 1 & -3 \\ 3 & 3 & 3 & 3 \\ 0 & 1 & -1 & 0 \\ -1 & 0 & 3 & 1 \\ 0 & 2 & 1 & 3 \end{pmatrix}$$

The row sum matrix

$$\begin{pmatrix} -5 \\ -4 \\ 12 \\ -2 \\ 3 \\ 6 \end{pmatrix}$$

The Graph depicting the maximum age group of women of CETD matrix

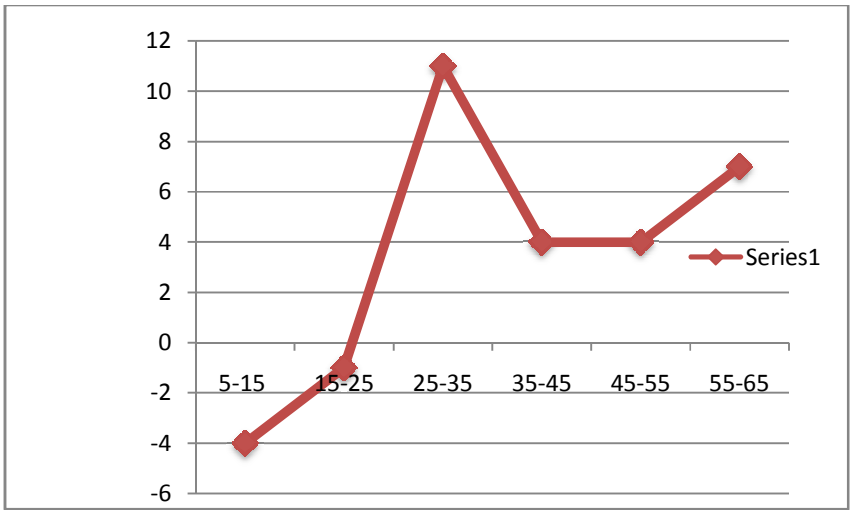

Figure 4: From the above graph, it is clear that women at the age group of 25-35 years having Anaemia

4. Suggestions and conclusions

Suggestions

It is essential to identify the cause of Anaemia. Iron deficiency, especially severe deficiency, causing Anaemia is serious and even life-threatening. Usually, it cannot be overcome by increasing dietary intake alone.

- Iron supplements, along with improved diet and eating habits, healthier hygiene and sanitation practices, deworming, and other solutions are nearly always required.
- The best absorption of iron is on an empty stomach, but many people are unable to tolerate this and may need to take the supplement with food.
- Milk and antacids containing calcium may interfere with absorption of iron and should not be taken at the same time as iron supplements.
- Taking vitamin C supplements or eating vitamin C-rich foods at the same time as iron supplements can increase absorption and is essential in the production of haemoglobin.
- The addition of meat or fish to a meal provides not only more absorbable iron, but also increases the absorption of non-haem iron, including fortificant iron.

5. Conclusions

A high proportion of women were suffering from various degrees of malnutrition that leads to Anaemia. Lack of Knowledge is one of the root causes of malnutrition in villages. From the above analysis, Anaemia starts at the age of 5. The peak age of women having anaemia is 25. The peak period for anaemia is 25-35. Anaemia occurs mostly at the age of 15, and the risk is especially high for a woman over the age 35.The result gets

confirmed by the above analysis with CETD matrix. From these results, it can be concluded that nutritional status as well as nutritional knowledge of village women is unsatisfactory and needs interventions.

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