



Fuzzy CETD matrix to estimate the maximum age group victims of pesticide endosulfan problems faced in Kerala

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ABSTRACT

This article is a comprehensive study to find out the maximum age group victims of Endosulfan people in South Indian State of Kerala (Palakkad and Kasargod) using CETD matrix. In the year 2003 W.B.Vasantha used to study migrant labours who were affected by HIV/AIDS. For this paper the data have been collected from Palakkad and Kasargod Dt. Of Kerala covering 101 victims. A detailed report on the harmful effect faced by the people with the usage of the pesticide in India was telecasted in Star T.V. dated June 24, 2012 "Satyameva Jayathe" anchored by film star Amir Khan.

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Introduction

Due to modernization now a days the pesticides are sprayed in agriculture (Mango, cashewnut, vegetables etc) for getting better yield. Endosulfan is commonly used pesticide. This pesticide creates a range of chronic effects including cancer, cerebral meningitis, skin diseases, vision loss and mental disorders and infertility of women. Our work is based on the field work conducted at 101 endosulfan victims at Palakkad and Kasargode Dt in Kerala. The data collected from the victims of Endosulfan is studied using this fuzzy matrix model. Using this model we estimate the maximum age group victims of Endosulfan. It is important to note while doing mathematical models the fuzzy matrix may take its entries $[-1, 1]$ then also they are known as fuzzy matrix.

The method of calculation of fuzzy CETD matrix

The real data collected from the 101 victims of Endosulfan in Kerala is studied using fuzzy matrix model. The raw data is taken as it is and transformed into a raw time dependent data matrix by taking along the rows the age group and along the column the reasons for became Endosulfan Victims. Using the raw data matrix, convert it into the Average Time Dependent Data (ATD Matrix) (a_{ij}) by dividing each entry of the raw data matrix by the number of years that is, the time period. This matrix represents a data, which is totally uniform. At the third stage we find the average and Standard Deviation (S.D) of every column in the ATD matrix. Using the average μ_j of each j^{th} column and σ_j the S.D. of each j^{th} column we chose a parameter α from the interval $[0,1]$ and form the Refined Time Dependent Matrix (RTD matrix), using the formula if $a_{ij} \leq (\mu_j - \alpha \cdot \sigma_j)$ then $e_{ij} = -1$ else if $a_{ij} > (\mu_j - \alpha \cdot \sigma_j, \mu_j + \alpha \cdot \sigma_j)$ then $e_{ij} = 0$ else $a_{ij} \geq (\mu_j + \alpha \cdot \sigma_j)$ then $e_{ij} = 1$. The ATD matrix is converted into Refined Time Dependent Data matrix. This matrix is also at times termed as the fuzzy matrix as the entries are 1, 0, -1. Now the row sum of this matrix give the maximum age group victims of this social problem. We also combine these matrices by varying $\alpha \in [0, 1]$, so that we get the Combined Effective Time Dependent

Data(CETD) matrix. The row sum is obtained for CETD matrix and conclusions are derived based on the row sums. All these are represented by graphs and graphs play a vital role in exhibiting the data.



Endosulfan affected girls (5), (7)

Estimation of maximum age group victims of Endosulfan using 6x8 matrixes

Using linguistic questionnaire from the 101 victims of Endosulfan we have taken the following selected concepts.

X₁ Better yield

X₂ No awareness on the effects of Endosulfan

X₃ Cheap cost

X₄ Availability of Endosulfan easily

X₅ No knowledge of anyother alternatives

X₆ Illiteracy

X₇ Govt. indifference to the owner of farms for using Endosulfan

X₈ Non involvements of Govt. / Social organizations

The above concepts are taken as the column of the initial raw data matrix. The age group in the years 0-10, 11-20, 21-30, 31-40, 41-50, and 51-60 are taken as the row of the matrix.

Initial Raw Data Matrix

Age Group	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈
0-10	39	42	25	41	41	9	42	42
11-20	29	34	21	33	33	7	34	34
21-30	8	8	6	8	8	0	8	8
31-40	8	8	7	8	8	0	8	8
41-50	4	4	3	4	4	0	4	4
51-60	4	4	3	4	4	0	4	4

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The ATD matrix

Age Group	X ₁	X ₂	X ₃	X ₄	X ₅	X ₆	X ₇	X ₈
0-10	3.9	4.2	2.5	4.1	4.1	0.9	4.2	4.2
11-20	2.9	3.4	2.1	3.3	3.3	0.7	3.4	3.4
21-30	0.8	0.8	0.6	0.8	0.8	0	0.8	0.8
31-40	0.8	0.8	0.7	0.8	0.8	0	0.8	0.8
41-50	0.4	0.4	0.3	0.4	0.4	0	0.4	0.4
51-60	0.4	0.4	0.3	0.4	0.4	0	0.4	0.4

The Average and Standard Deviation of the above ATD matrix

Mean	1.53	1.6	1.08	1.56	1.56	0.26	1.6	1.6
S.D	1.85	1.82	0.88	1.48	1.48	0.49	1.53	1.53

RTD matrix for $\alpha=0.1$

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

The row sum matrix

$$\begin{pmatrix} 9 \\ 9 \\ -8 \\ -9 \\ -9 \\ -9 \end{pmatrix}$$

RTD matrix for $\alpha=0.15$

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

The row sum matrix

$$\begin{pmatrix} 8 \\ 7 \\ -9 \\ -9 \\ -9 \\ -9 \end{pmatrix}$$

RTD matrix for $\alpha=0.2$

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

The row sum matrix

$$\begin{pmatrix} 9 \\ 9 \\ -7 \\ -7 \\ -9 \\ -9 \end{pmatrix}$$

Conclusions

From the above CETD matrix analysis the maximum Endosulfan victims are at the age group of 0-20. It is not changed with the change in values of the parameter from 0 to 1. But the age group 21-30, 31-40, 41-50 and 51-60 are negative because only few people became victims of Endosulfan at this age group. Also at the age group 0-20 are affected with types diseases like epilepsy, skin diseases, cancer, neurobehaviour disorders etc. Also most of these people are illiterate. When Govt, social organizations will give awareness about the side

effects of Endosulfan and it will effect to the next generation also.

RTD matrix for $\alpha=0.3$

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

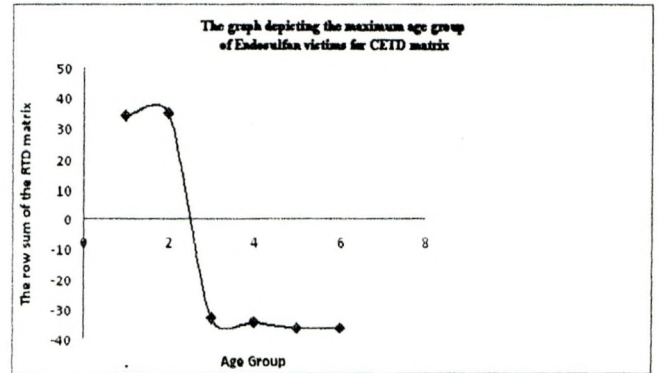
The row sum matrix

$$\begin{pmatrix} 9 \\ 9 \\ -9 \\ -9 \\ -9 \\ -9 \end{pmatrix}$$

CETD matrix

$$\begin{pmatrix} 4 & 4 & 4 & 4 & 4 & 2 & 4 & 4 \\ 4 & 4 & 4 & 4 & 4 & 3 & 4 & 4 \\ -4 & -4 & -2 & -3 & -4 & -4 & -4 & -4 \\ -4 & -4 & -3 & -3 & -4 & -4 & -4 & -4 \\ -4 & -4 & -4 & -4 & -4 & -4 & -4 & -4 \\ -4 & -4 & -4 & -4 & -4 & -4 & -4 & -4 \end{pmatrix}$$

The row sum of CETD matrix

$$\begin{pmatrix} 34 \\ 35 \\ -33 \\ -34 \\ -36 \\ -36 \end{pmatrix}$$


In vegetable cultivation many fields trials have been carried out on alternative pest control methods focusing on herbal pesticides. In some studies, botanical pesticides were found more effective than endosulfan in controlling greenhouse pests. In Asion region farmers have developed their own combinations and methods of pest control using chillies, garlic, asafetida, cow urine and many other plant materials. Many cashew farmers have tried organic method and application of neem oil. Alternative pesticides and organic farming are encouraged in tea plantations and the use of endosulfan is being eliminated. Sadly, awareness about non pesticide management is negligible in our country. Subsidies to be implemented on organic farming and use of insecticides need to be stopped on an immediate basis. There is anyways enough stress and other kinds of pollution that is harming us. We don't want our foods to be harmful as well. Let us all raise a voice!

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