



Identification of Age Groups Vulnerable to Asthma Disease using CETD Matrix

E.Pushpalatha

Department of Mathematics
Nirmala College for Women,
Coimbatore, Tamil Nadu, India

A.Sahaya Sudha

Department of Mathematics
Nirmala College for Women
Coimbatore, Tamil Nadu, India

V.Saravanakumar

Department of Agricultural Economics
Tamil Nadu Agricultural University
Coimbatore, Tamil Nadu, India

Abstract- In this paper the vulnerable age group which gets affected due to induced air pollution is identified using CETD matrix approach. It is based on the study on 60 Asthma patient's having Asthma symptoms of raw data from a residential area in Coimbatore city.

Keywords- ATD Matrix, RTD Matrix, CETD Matrix, Asthma diagnosis, Vulnerable Age Group

I. INTRODUCTION

CETD matrix is the technique used to find the Asthma for the different types of age group. Environmental pollution is one of the serious crisis to which we are facing today. Many of the mathematicians have worked on real world problems using the concept of fuzzy matrices. This type of problem was tackled first time using an algebraic application the solution is obtained as a column matrix.

II. LITERATURE REVIEW

Vasanth Kandasamy et al., 2005 [7] studied the social and psychological problems faced by rag pickers using CETD matrix. Jose Praveena Nicholas et al, 2012 [3] to identify the maximum age group to affect by stress problems for the teachers in Chennai by using CETD matrix method. Kuppuswami.G et al.2015 [5], Study of Traffic Flow using CETD matrix. Narayanamoorthy 2012 [6] to estimate the maximum age group of silk weavers as bonded labourers using CETD matrix. Iftikhar et al., 2016 [2] also identified the maximum age-group of cigarette smokers who have started smoking due to various reasons using CETD matrix. Albert William. A, et al., 2013 [1] analyzed the breast cancer using RTD matrix, international journal of computing algorithm. Victor Devadoss et al., 2013 [9] to estimate the Women Teachers Affected by Stress problem in Chennai Schools Using CETD Matrix. Victor Devadoss. A, 2012 [8] Dimensions of Personality of Women in Chennai using CETD Matrix.

III. PRELIMINARIES

Definition 2.1 [7]

Time Dependent Data Matrix (ATD Matrix) (a_{ij}) is obtained by dividing each entry of the raw data matrix by the number of years or the time period (i.e.,) the difference of the class interval of each row. This matrix represents a data, which is totally uniform.

Definition 2.2 [7]

The time dependent matrix has been converted into matrix with entries e_{ij} , where $e_{ij} \in \{-1,0,1\}$ using simple average techniques and such a matrix is called as Refined Time Dependent matrix (RTD matrix).

Definition 2.3[4]

Using the Refined Time Data matrices we obtained the Combined Effective Time Dependent Data Matrix (CETD Matrix) which gives the cumulative effect of all those entries. This is done by finding the row sum matrix of the RTD matrix and also by combining these matrices by varying $\alpha \in [0,1]$, so that we get a CETD matrix.

IV. PROPOSED METHOD FOR DETERMINING THE VULNERABILITY OF AGE TO ASTHMA

All the age groups of people were suffered from asthma. In this section we will make use of the CETD matrix to identify the different age group of people affected by the Asthma. The concentration of the air pollutant was measured in some Residential areas in Coimbatore city. The primary data were collected from the sample of 60 asthma patients from the different residential areas of Coimbatore during the year 2016. Based on the symptoms of Asthma such as Cough, Wheezing, Chest congestion, Anxiety disorders, running nose and Watery eyes were collected from reliable sources from the Age Groups 1-5 to 26-30.

The results of raw data and their mean, standard deviations, Average Time Dependent (ATD) data, Refined Time Dependent (RTD) data and Combined Effective Time Dependent data (CETD) matrices are given below. The results of RTD and CETD are interpreted by graphs which are exhibiting the data by the simplest way. In this chapter, we used Combined Effective Time Dependent (CETD) matrix is used to identify the vulnerable age group for asthma.

V. ALGORITHM FOR THE PROPOSED METHOD

Step I

The raw data is transformed into a raw time dependent data matrix by taking along the row the different age group of peoples and along the columns the different symptoms of Asthma.

Step II

The raw data matrix is converted in to the Average Time Dependent Data (ATD) matrix by dividing each entry of the raw data matrix by the time period. This matrix represents a data, which is totally uniform.

Step III

Here the average or mean and the Standard deviation (S.D.) of every column in the ATD matrix is determined.

Step IV

Using the average of each column and the S.D of each column, a parameter from the interval [0, 1] is chosen and the Refined Time Dependent Data matrix (RTD matrix) is formed using the formula:

if $a_{ij} \leq (\mu_j - \alpha * \sigma_j)$ then $e_{ij} = -1$
 else
 if $a_{ij} \in (\mu_j - \alpha * \sigma_j, \mu_j + \alpha * \sigma_j)$ then $e_{ij} = 0$
 else
 if $a_{ij} \geq (\mu_j + \alpha * \sigma_j)$ then $e_{ij} = 1$,

Where a_{ij} 's are the entries of the ATD matrix.

Step V

The ATD matrix is refined into the RTD matrix whose entries are -1, 0 or 1. Now the row sum of this matrix gives the different age groups. By varying the parameter $\alpha \in [0, 1]$, these matrices can be combined to get the CETD matrix (Kuppuswami.G, Victor Devadoss, 2015, 2013) [5, 11].

Step VI

The row sum is obtained for CETD matrix and conclusions are derived based on row sums. The CETD matrices are represented by graphs and graphs play a vital role in exhibiting the data by the simplest means which can be even understood by a layman, (Kirupa.A,2013) [4].

VI. IDENTIFYING THE DIFFERENT AGE GROUP OF PEOPLE TO BE AFFECTED BY ASTHMA DISEASE

Symptoms of Asthma disease observed in different age group of people in residential area are given below.

X₁: Cough

X₂: Wheezing

X₃: Chest congestion

X₄: Anxiety disorders

X₅: Running nose and Watery eyes

In this above numerical example The attributes X₁, X₂, ..., X₅ are taken as columns of the initial raw data matrix, and the age-group in years 1-5, 6-10, 11-15, 16-20, 21-25, and 26- 30 are taken as the rows of the matrix.

Step I:

Table 1 Persons Affected by the Symptoms of Asthma Disease

Age group	Cough (X ₁)	Wheezing (X ₂)	Chest congestion (X ₃)	Anxiety disorders (X ₄)	Running nose and Watery eyes (X ₅)
1-5	3	3	1	0	3
6-10	3	0	3	0	3
11-15	1	2	4	0	0
16-20	1	0	0	2	3
21-25	3	5	1	0	1
26-30	1	3	1	0	1

Step II

Table 2 Initial Raw data and the ATD Matrix of Asthma Disease

Age Group	Raw Data					Average Time Dependent (ATD) Matrix				
	X ₁	X ₂	X ₃	X ₄	X ₅					
1-5	3	3	1	0	3	0.6	0.6	0.2	0	0.6
6-10	3	0	3	0	3	0.6	0	0.6	0	0.6
11-15	1	2	4	0	3	0.2	0.4	0.8	0	0.6
16-20	1	0	0	2	3	0.2	0	0	0.4	0.6
21-25	3	5	1	0	1	0.6	1	0.2	0	0.2
26-30	1	3	1	0	1	0.2	0.6	0.2	0	0.2

Step III

Table 3 The ATD matrix

Mean	0.40	0.43	0.33	0.07	0.47
SD	0.22	0.39	0.30	0.16	0.21

Step IV:

Case (i): The RTD matrix for $\alpha = 0.3$ and the row sum matrix is

$$\begin{matrix}
 \text{RTD Matrix} & \text{Row sum matrix} \\
 \begin{pmatrix} 1 & 1 & -1 & -1 & 1 \\ 1 & -1 & 1 & -1 & 1 \\ -1 & 0 & 1 & -1 & 1 \\ -1 & -1 & -1 & 1 & 1 \\ 1 & 1 & -1 & -1 & -1 \\ -1 & 1 & -1 & -1 & -1 \end{pmatrix} & \begin{pmatrix} 1 \\ 1 \\ 0 \\ -1 \\ -1 \\ -3 \end{pmatrix}
 \end{matrix}$$

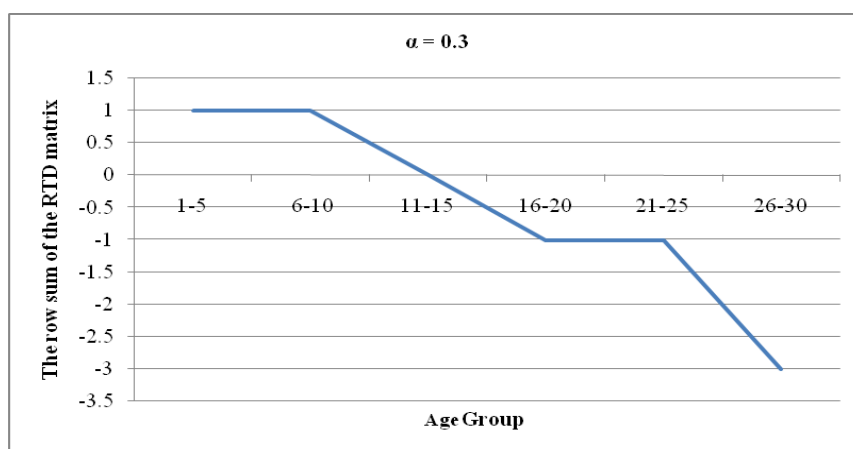


Fig 1 Graph depicting the different age group to be affected by Asthma for $\alpha = 0.3$

Case (ii): The RTD matrix for $\alpha = 0.5$ and the row sum matrix is

$$\begin{matrix}
 \text{RTD Matrix} & \text{Row sum matrix} \\
 \begin{pmatrix} 1 & 0 & 0 & 0 & 1 \\ 1 & -1 & 1 & 0 & 1 \\ -1 & 0 & 1 & 0 & 1 \\ -1 & -1 & -1 & 1 & 1 \\ 1 & 1 & 0 & 0 & -1 \\ -1 & 0 & 0 & 0 & -1 \end{pmatrix} & \begin{pmatrix} 2 \\ 2 \\ 1 \\ -1 \\ 1 \\ -2 \end{pmatrix}
 \end{matrix}$$

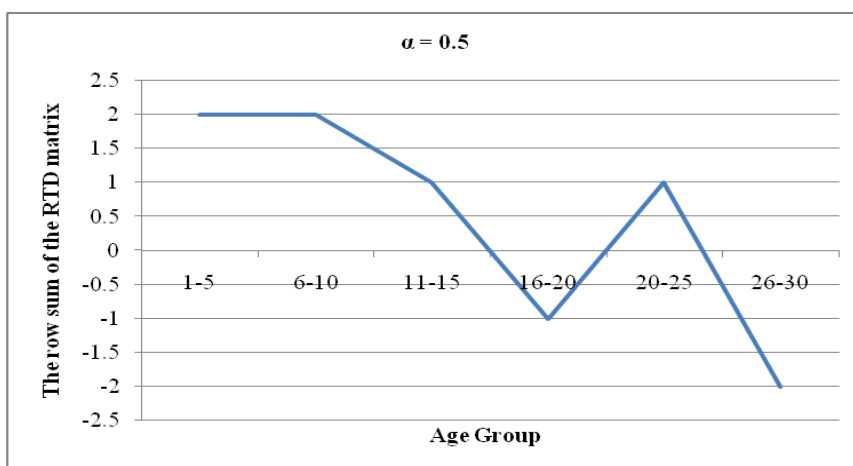


Fig 2 Graph depicting the different age group to be affected by Asthma for $\alpha = 0.5$

Case (iii): The RTD matrix for $\alpha = 0.75$ is and the row sum matrix is

RTD Matrix	Row sum matrix
$\begin{pmatrix} 1 & 0 & 0 & 0 & 0 \\ 1 & -1 & 1 & 0 & 0 \\ -1 & 0 & 1 & 0 & 0 \\ -1 & -1 & -1 & 1 & 0 \\ 1 & 1 & 0 & 0 & -1 \\ -1 & 0 & 0 & 0 & -1 \end{pmatrix}$	$\begin{pmatrix} 1 \\ 1 \\ 0 \\ -2 \\ 1 \\ -2 \end{pmatrix}$

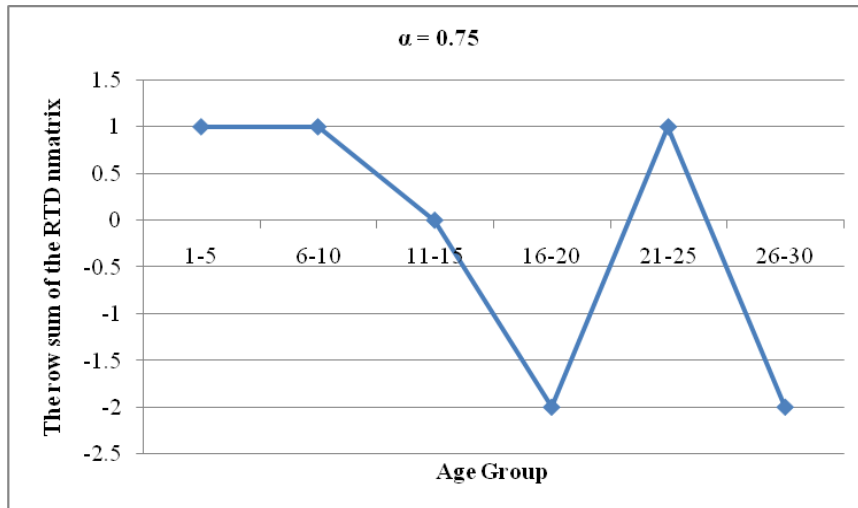


Fig 3 Graph depicting the different age group to be affected by Asthma for $\alpha = 0.75$

Step V

The comparative graph depicting the different age group to be affected by the Asthma in residential area.

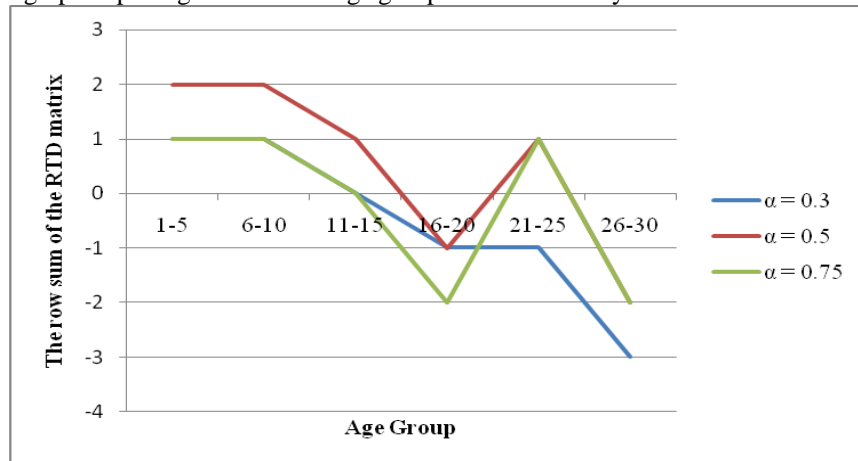


Fig 4 Different age group to be affected by Asthma for different values of $\alpha = 0.3, 0.5, 0.75$

Step VI

The combined effect time dependent matrix for all the values of $\alpha \in [0, 1]$ is

CETD matrix	Row sum matrix
$\begin{pmatrix} 3 & 2 & 0 & 0 & 2 \\ 3 & -1 & 3 & 0 & 2 \\ -3 & -1 & 1 & -2 & 0 \\ 3 & -3 & -3 & 1 & 0 \\ 3 & 3 & 0 & 0 & -1 \\ -3 & 0 & -2 & 2 & -3 \end{pmatrix}$	$\begin{pmatrix} 7 \\ 7 \\ -5 \\ -8 \\ 5 \\ -10 \end{pmatrix}$

The row sum of the above combined time dependent data matrix. We observed that identifying the maximum age group of people to be affected by the Asthma in Residential Area corresponding to the first row and the second row.

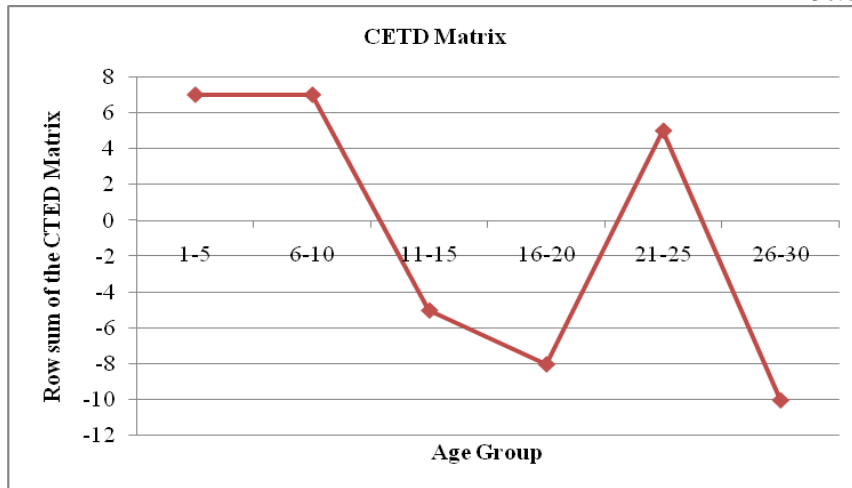


Fig 5 Graph depicting the different age group to be affected by the Asthma for CETD matrix.

From the results of the combined time dependent data matrix, given by the cumulative effect of all the values of $\alpha \in [0, 1]$ revealed that the age groups 1-5 and 6-10 were highly affected by asthma caused by air pollution.

VII. CONCLUSION

It was concluded that the people under different age-groups were significantly affected by the air pollution causing Asthma in Residential area. It was recorded that the symptoms like cough, wheezing, chest congestion, Anxiety disorders, running nose and watery eyes were commonly prevalent due to Asthma disease. Sixty respondents among six different age groups from the age one to 30 were surveyed for this study, of which, it was found that the children under age groups 1-5 and 6-10 were the most vulnerable due to air pollution causing Asthma. Whereas, the respondents under the higher age groups viz., 11-15, 16-20, 21-25 and 26-30 were less likely affected due to the air pollution.

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