Mortality Rate Due to Pulmonary Fibrosis Associated with Sars-Cov-2 Infection: Scope of Best Fit Regression

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Research Article

Keywords: SARS-COV-2, Idiopathic pulmonary fibrosis (IPF), Best fit regression, Harris model, JSON coding, Mortality contour

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MORTALITY RATE DUE TO PULMONARY FIBROSIS ASSOCIATED WITH SARS-COV-2 INFECTION:

SCOPE OF BEST FIT REGRESSION

(JAYDIP DATTA)

ABSTRACT :

In this article mortality rate (1) due to pulmonary fibrosis (2,3) associated with SARS-COV-2 (4,5) is analysed at the early stage of Covid19 infection globally with effect from 21st January to 28th April ,2020 (6). Pulmonary fibrosis may be considered as one of the major cause of death due to severe acute respiratory syndrome (SARS –COV-2)(5) infection . The mortality percentage data(5) within a total ninety eight days are analysed by best fit regression(7) like Polynomial – Morgan Morgan Finney (MMF) (7, 8,9)- Harris model are analysed in detail to compare the scope of best fit with two prime epidemiological parameters like mortality percentage (6) vs duration in days with regular interval of seven days . The entire statistical analysis is computationally analysed by a standard coding of data analysis (11).

KEYWORDS : SARS-COV-2 , Idiopathic pulmonary fibrosis (IPF), Best fit regression , Harris model , JSON coding , Mortality contour,

INTRODUCTION :

Lung fibrosis(2,3) is proportionally linked to infectivity of SARS-COV-2 (**1,12**) causing severely low respiratory rate , leading to death as a failure of even ventilator system in ICU .The diagnostic (13) system used for detection of fibrosis is Chest –X-Ray (CXR) , CT – MRI Scan , and RT-PCR test indicating the severity of this pulmonary infection .It is also called as idiopathic pulmonary fibrosis (IPF) causing pneumonia of SARS-COV-2 fatality . The comorbidities (2,3,14) like hypertension, diabetes , renal failure are also participating this pulmonary sepsis (5,6).

OBJECTIVE :

The **main objective** of this best fit regression statistics is to **correlate** the following data analysis fit starting from Polynomial – MMF – **Harris** regression (7,8,9) for a better explanation of fatality of Covid19 infection (4,5).The mortality rate (MR)(1) increases from 2.13 to 6.86 % at the earlier stage in absence of any potent antiviral like Remdesivir(15) , Lopinavir – Ritonavir ,Flavipiravir (12,15) and Dexamethasone like life saving medicines. In that case the chosen data showing the statistical significance of this case fatality study (CFR) (1,13) of pulmonary fibro – sepsis death .

METHODS (7-10): 1) The data matrix [**R15 X C4**] (Figure-I ,6) is represented for statistical analysis . [R1 – 21.01.20 to R15 – 28.04.20] @ 7days interval . [C1- Frequencies of Infectivity's , C2 – Death Frequencies , C3 – Mortality rate (%) , C4- Number of days .

282	6	2.13	0 R1
4593	106	2.31	7 R2
20630	426	2.06	14 R3
43103	1018	2.36	21 R4
73332	1873	2.55	28 R5
80239	2700	3.36	35 R6
90869	3112	3.42	42 R7
113702	4012	3.53	49 R8
179111	7426	4.15	56 R9
372755	16231	4.35	63 R10
750890	36405	4.85	70 R11
1279722	72614	5.67	77 R12
1844863	117201	6.34	84 R13
2397217	162956	6.8	91 R14
2954222	202597	6.86	98 R15
Infected	Death frer	Mortality %	
C1	C2	C3	C4
			15 * 4
			Mat

Figure – I (6)

2) Best Fit Software – **Curve Expert (V.1.4)**

3) Spread sheet representation (Excel, Office -2007) -Figure –II to Figure VI .

Figure – II (Variation of Infection Frequencies vs Number in days)

Figure – III (Variation of Infection Vs Death Frequencies)

Figure – IV (Scattered variation of Infection frequencies Vs Mortality Rate [%])

Figure – V (3D -Surface variation of Mat [R15 X C4])

Figure – VI (3D-Contour variation of Mat [R15 x C4])

Figure – V & Figure – VI – A composite surface – contour variation of Infection frequencies, Death frequencies, Mortality rate (%) , Number of days during pulmonary fibro-sepsis due to SARS-COV-2

RESULTS (16-20):

The results may be considered by the execution of **Curve Expert V.1.4** using data matrix [R15 x C 4] as follows . The bi-variant scattered curves **Figure – II ,III, IV** are executed to best fit curves of polynomial , MMF and Harris regression with relevant Pearson coefficients (r) and standard error (s).

4th Order Polynomial(16) Fit

Figure - VII

Model Equation [Figure –VII , 16] : $Y(\text{Death Freq}) = a + b \cdot X + c \cdot X^2 + d \cdot X^3 + e \cdot X^4 + \dots \dots (1)$

x = Infection frequency, a ,b,c , d ,e = Coefficients of regression .

Morgan – Morgan – Finney (MMF) Fit -

Figure - VIII

Model Equation [Figure –VIII, 16] : Y [Number of days] = $(a*b + c *X^d) / (b + X^d)$ ----- (2)

X = Infection Frequency, a , b , c , d = Coefficients of regression .

Harris Fit -

Figure – IX

Model Equation [Figure – IX ,16] : Y [Mortality rate %] = $a + b * c ^X$ ----- (3)

X = Infection Frequency, a , b , c = Coefficients of regression .

In each model equation [16](1),(2) ,(3) with Chi-sq hypothesis(7) (MMF , Harris model) , Covariance Matrix [4 x 4 sq , 3 x 3 Sq](17) for Polynomial – **MMF** – Harris fit (**Figure – VII ,VIII, IX** respectively .A coding of data- structure (preferably C , C++) (11)corresponding to best fit data analysis represents the coding statement (20 , **JSON EXPORT**).

CONCLUSION : The model equations (1) ,(2),(3) showing variation of Death frequency , Number of days , Mortality rate (%) with Infection frequency due to Pulmonary fibrosis as a result of SARS-COV-2 Infection(4,5) at the early stage of Covid19 pandemic. The independent variable Infection frequency increasing nonlinearly with Death Freq – Number of days – Mortality rate (%) correlating the **goodness of fit (7,10)** .The Pearson coefficient (r) (8)= **0.9999 , 0.9908 , 0.9812** [$0 < r < 1$] **optimising (18)** P value < 0.0001 [@ 0.01 , tolerance of convergence (19)– confidence limit (CI)> 95 %]of standard error (s) correlating **Harris Fit** (Figure –IX)> **MMF Fit**(Figure -VIII ,9) > **Polynomial fit**(Figure – VII) . The mortality rate (1) due to Idiopathic pulmonary fibrosis (IPF)(2,3) becoming more and more significant including comorbidities reinforcing the death percentage (%) from 2.13 – 6.86 as per global survey data (6) .

CONFLICT OF INTEREST: I hereby declare that I have no conflict of interest / competing interest.

CODING STATEMENT (20)-

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Figures

282	6	2.13	0 R1
4593	106	2.31	7 R2
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43103	1018	2.36	21 R4
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1844863	117201	6.34	84 R13
2397217	162956	6.8	91 R14
2954222	202597	6.86	98 R15
Infected	Death free	Mortality %	
C1	C2	C3	C4

Figure 1

Best Fit Software – Curve Expert (V.1.4) Spread sheet representation (Excel, Office -2007)

Figure 2

Variation of Infection Frequencies vs Number in days

Figure 3
 Variation of Infection Vs Death Frequencies

Figure 4
 Scattered variation of Infection frequencies Vs Mortality Rate [%]

Figure 5

3D -Surface variation of Mat [R15 X C4] -A composite surface – contour variation of Infection frequencies, Death frequencies, Mortality rate (%) , Number of days during pulmonary fibro-sepsis due to SARS-COV-2

Figure 6

3D-Contour variation of Mat [R15 x C4] -A composite surface – contour variation of Infection frequencies, Death frequencies, Mortality rate (%) , Number of days during pulmonary fibro-sepsis due to SARS-COV-2

Figure 7

4th Order Polynomial(16) Fit - Model Equation [Figure –VII , 16] : $Y(\text{Death Freq}) = a + b \cdot X + c \cdot X^2 + d \cdot X^3 + e \cdot X^4 + \dots$ (1) x = Infection frequency, a, b, c, d, e = Coefficients of regression .

Figure 8

Morgan – Morgan – Finney (MMF) Fit - Model Equation [Figure –VIII, 16] : Y [Number of days] = $(a*b + c *X^d) / (b + X^d)$ —(2) X = Infection Frequency, a , b , c , d = Coefficients of regression .

Figure 9

Harris Fit - Model Equation [Figure – IX ,16] : $Y [\text{Mortality rate \%}] = a + b * c^X$ ———(3) $X = \text{Infection Frequency}$, $a, b, c = \text{Coefficients of regression}$.

Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [SupplementaryDataSARSCOV2lungfibrosis.docx](#)