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Mathematical Model for Fear of dying and inflammation following ACS

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ABSTRACT

A transmutted modified Weibull distribution as an important competitive model which contains eleven life time distributions as special cases. We evaluated the damage of hazard function by using fear of dying, associations with inflammatory responses during ACS and later heart rate variability (HRV) and cortisol secretion by using hazard function.

Keywords: ACS, HRV, TMW, RF, EKG, IRB.

INTRODUCTION:

Information was obtained from medical notes about cardio vascular history, clinical factors during admission and management.

Tumour necrosis factor was measured from blood samples obtained on admission to hospital using an immunometric assay using an Immulite 1 system. Intra-assay andinterassay coefficients of variation were 2.6-3.6% and 4.0-6.5% respectively

Cortisol output was assessed by measuring the profile of salivary cortisol over a day. Salivary sampling with salivettes was explained and practiced during the test session in the patient's home. Patients were asked to hold the cotton dental roll in their mouths until saturated (for 2 min) at six times: immediately after waking, 30 min later, 10:00-10:30, 14:00 - 14:30, 19:00-19:30 h, and then just before bedtime. They also recorded the exact time of sample collection and the time of waking. Patients were instructed to avoid caffeine and acidic drinks, smoking, tooth brushing, eating and drinking for 15 min before collecting saliva. Salivettes were stored in domestic refrigerators before posting them back to the laboratory. Patients who did not return their samples within 2 weeks were sent reminders and replacement salivettes if necessary. Saliva samples were sent to the technical University Dresden for the analysis of cortisol using a commercial immunoassay with chemiluminescence detection. Inter – and intra – assay coefficients of variation were <8%.

Of the 208 patients in this study, 161 were interviewed at home 3 weeks after their ACS, and satisfactoryHRV data were obtained from 106 and cortisol from 110. Reasons for not participating in the home interview included refusal (55%) , further health problems (read-mission, cognitive impairment, 16%) or failure to establish contact despite repeated attempts (29%). Comparison of patients who were included and excluded from the analysis showed on difference in age, gender, ethnicity, type of ACS, clinical measures, fear of dying or TNFα on admission. However, individuals who failed to provide data at the 3-week assessment point were more likely to be unmarried (P = 0.005) and of lower SES (P = 0.019)

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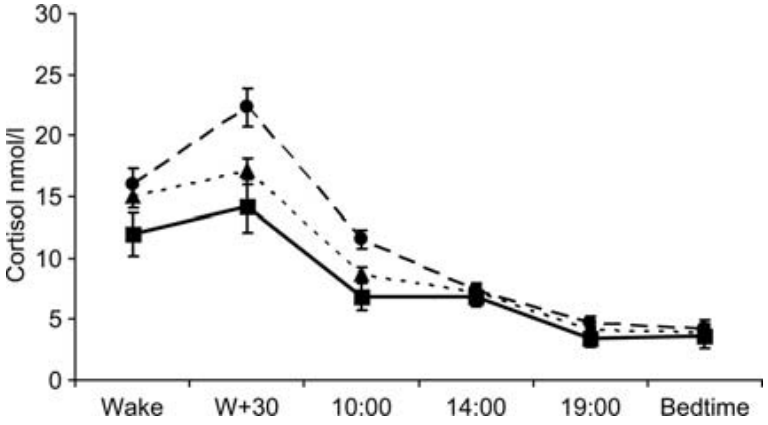

The purpose of this study was to investigate links between acute emotional and acute inflammatory responses to ACS and to test their associate with cardiac autonomic control and cortical secretion.

Mathematics Model:

The relationship between shape parameter and other properties such as non-reliability function, Recently Ammar et al. [10] proposed the modified Weibull distribution.

$$F_{MW}(t)=1-\exp\left(-\alpha\, t-\eta t^{\beta}\right) \longrightarrow 1$$

TRANSMUTED MODIFIED WEIBULL DISTRIBUTION:

A random variable T is said to have transmulted Modified Weibull probability distribution with parameters $\alpha,\beta,\eta>0$ and -1.$\leq \lambda \leq 1$. It can be used to represent the failure probability density function is given by

$$f_{TMW}(t)=(\alpha+\beta\eta t^{\beta-1})\exp((-\alpha t-\eta t^{\beta})(1-\lambda+2\lambda\exp((-\alpha t-\eta t^{\beta}))\ t>0 \longrightarrow 2$$

Where β and η are the shape parameters representing the different patterns of the transmuted modified Weibull distribution and are positive, α is a scale parameter representing the characteristic life and is also positive, λ is the transmuted parameter. The restrictions in equation (2) on the values of $\alpha,\beta,\eta\ and\ \lambda$ are always the same.

The Cumulative hazard function of the transmuted modified Weibull distribution is de-noted by $H_{TMW}(t)$ and is defined as

$$H_{TMW}(t)=-ln\left|\left(1-\exp\left(-\alpha t-\eta t^{\beta}\right)\right)\left(1+\lambda\exp\left(-\alpha t-\eta t^{\beta}\right)\right)\right| \longrightarrow 3$$

It is important to note that the units for H_{TMW} (t) is the cumulative probability of failure per unit of time, distance or cycles.

The hazard rate function of the transmuted modified weibull distribution has the following properties

The hazard function (HF) of the transmuted modified Weibull distribution is given in equation (6) has the special cases with different choice of parameters

i. If $\beta=1$

$$h_{TME}(t)=\frac{(\alpha+\eta)\exp(-\alpha t-\eta t)(1-\lambda+2\lambda\exp(-\alpha t-\eta t))}{1-(1-\exp(-\alpha t-\eta t))(1+\lambda\exp(-\alpha t-\eta t))}$$

ii. If $\beta=2$

$$h_{TLFR}(t)=\frac{(\alpha+2\eta t)\exp(-\alpha t-\eta t^{2})(1-\lambda+2\lambda\exp(-\alpha t-\eta t^{2}))}{1-(1-\exp(-\alpha t-\eta t^{2}))(1+\lambda\exp(-\alpha t-\eta t^{2}))}$$

iii. If $\alpha=0$

$$h_{TW}(t)=\frac{(\beta\eta t^{\beta-1})\exp(-\eta t^{\beta})(1-\lambda+2\lambda\exp(-\eta t^{\beta}))}{1-(1-\exp(-\eta t^{\beta}))(1+\lambda\exp(-\eta t^{\beta}))}$$

iv. If $\alpha=0,\beta=1$

$$h_{TE}(t)=\frac{(\eta)\exp(-\eta t)(1-\lambda+2\lambda\exp(-\eta t))}{1-(1-\exp(-\eta t))(1+\lambda\exp(-\eta t))}$$

v. If $\alpha=0,\beta=2$

$$h_{TR}(t)=\frac{(2\eta t)\exp(-\eta t^{2})(1-\lambda+2\lambda\exp(-\eta t^{2})}{1-(1-\exp(1-\eta t^{2}))(1+\lambda\exp(-\eta t^{2}))}$$

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vi. If $\lambda = 0$

$h_{MW}(t)=\frac{(\alpha+\beta\eta t^{\beta-1})\exp(-\alpha t-\eta t^{\beta})}{1-(1-\exp(-\alpha t-\eta t^{\beta}))}$

vii. If $\lambda = 0, \beta = 1$

$h_{ME}(t)=\frac{(\alpha+\eta)\exp(-\alpha t-\eta t)}{1-(1-\exp(-\alpha t-\eta t))}$

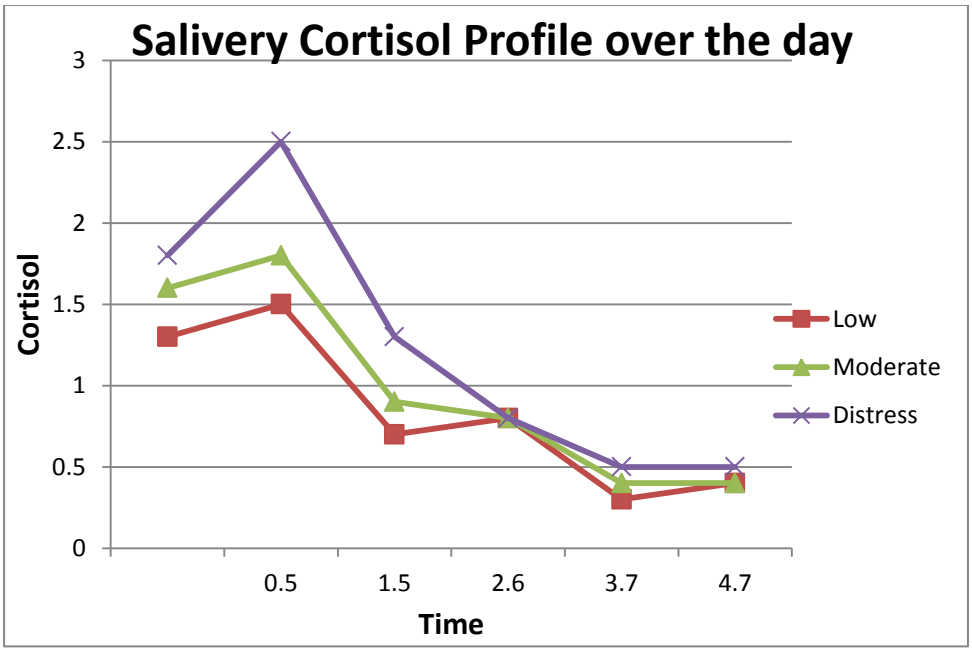
viii. If $\lambda = 0, \beta = 2$

$h_{MR}(t)=\frac{(\alpha+2\eta t)\exp(-\alpha t-\eta t^{2})}{1-(1-\exp(-\alpha t-\eta t^{2}))}$

Cortisol level due to Stress Effect in Patients experience low moderate intense distress

S. No.	Time	H(t) $\beta = 1$	H(t) $\beta = 2$	H(t) $\alpha = 0$	H(t) $\alpha = 0$ $\beta = 1$	H(t) $\alpha = 0$ $\beta = 2$	H(t) $\lambda = 0$	H(t) $\lambda = 0$ $\beta = 1$	H(t) $\lambda = 0$ $\beta = 2$
1	0.5	1.8708	1.9113	0.8091	0.7695	0.7848	0.3169	1.3	1.3
2	1.5	1.5279	2.5924	1.6771	0.7073	1.9917	2.0449	1.3	2.3
3	2.6	1.3636	3.4706	2.0933	0.6452	2.7273	2.7273	1.3	3.4
4	3.7	1.3030	5.5	2.5238	0.5959	4	3.3333	1.3	4.5
5	4.7	1.3333	2	3	0.5619	2	4.2857	1.3	5
6	5.8	1.4	0.01	1.7143	0.5378	2	4.2857	1.3	3.3

Time	Low	Moderate	Distress
0.5	1.3	1.6	1.8
1.5	1.5	1.8	2.5
2.6	0.7	0.9	1.3
3.7	0.8	0.8	0.8
4.7	0.3	0.4	0.5
5.8	0.4	0.4	0.5



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CONCLUSION:

Heightened inflammation during ACs and intense distress and fear of dying may be related manifestations of an acute bio behavioural response. The association between the two indicates a linkage between emotional and inflammatory responses during ACs that is independent of background characteristics and other aspects of clinical disease. They were both related to biological responses relevant to longer - term risk. We found the hazard function of different times in different choice of parameter for the reciprocal relationship between psychological and biological factors in acute heart disease, raising the possibility of new avenues for patient management. Mathematical result and medical result are coincide.

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