CALCULATING THE SURVIVAL TIME OF CANCER PATIENTS THROUGH EXPONENTIATED WEIBULL DISTRIBUTION

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A*bstract*

In this a paper a model is obtained for the expected time of breakdown point to reach the threshold level of cancer patient. The time to cross the threshold of the infected person is a vital event in cancer patient. With the model description study for the survival time of cancer patient is found through the exponentiated weibull family

Keywords: Exponentiated weibull distribution, cancer patient, threshold, survival time

1. Introduction

Exponentiatedweibull distribution (EWD) family not only cover the one parameter exponential family exponentiated exponential family as a sub-family, but also covers the most popular used two-parameter weibull family as a special sub-family one of the nice feature of EWD family is the gift close non-monotonic hazard function success unimodal shaped and bathtub shaped, appeared in science, engineering and medical Fields. Our goal is to determine how the infectiousness of semen of Cancer infected men various by stage of disease. The actual infection s will vary from person to person so we will compute an average. It will also depend on the type of smoking drinking and etc., higher for some type than for others. Mathematical model is obtained for the expected time of break down point to reach the threshold level. In the context of cancer, the assumption that the times between decision periods are independent and identically distributed (i.i.d)random variable. One can see for more detail about the expected time to cross the threshold level of stages period in pandiyan et al., 2018.

These assumptions are somewhat artificial, but are made because of the lack of detailed real-world information on one hand and in order to illustrate the proceedings on the other hand. Smoking, drinking contacts are the only source of Cancer infection. The threshold of any individual is a random variable. If the total damage crosses a threshold level Y which itself is a random variable, the interarrival time between successive contact, the sequence of damage and the threshold are mutually independent.

2. NOTATIONS

$\boldsymbol{X_1}$: A continuous random variable denoting the amount of damage/ depletion caused to the system due to the exit of persons on the ist occasion of policy announcement, i=1,2,3,…k and Xi's are i.i.d and Xi = X for all i.

$\boldsymbol{Y}$: A continuous random variable denoting the threshold level having three parameter exponentiated Weibull distribution.

$\boldsymbol{g}(.)$: The probability density function of Xi

$\boldsymbol{g_k}(.)$: The k-fold convolution of g(.) i.e., p.d.f of $\sum_{i=1}^{k} \boldsymbol{X_i}$

$\boldsymbol{g} * (.)$: Laplace transform of g(.); $\boldsymbol{g_k^*}(.)$: Laplace transform of $\boldsymbol{g_k}(.)$

$\boldsymbol{h}(.)$: The p.d.f of random threshold level which has three parameter exponentiated Weibull distribution and H(.) is the corresponding probability generating functions

$\boldsymbol{U}$: a continuous random variable U denoting the inter-arrival times between decision epochs.

$\boldsymbol{V_k(t)}$: $\boldsymbol{F_{k+1}(t)}$

$\boldsymbol{F_k(t)}$: Probability that there are exactly 'k' policies decisions in (0, t]

$\boldsymbol{S}(.)$: The survivor function i.e.,$[\boldsymbol{T > t}]$; $\boldsymbol{1 - S(t) = L(t)}$

3. MODELS DESCRIPTION

Let Y be the random variable which has the cdf defined as

$$F(x;\theta) = \left[1 - e^{-\left(\frac{x}{\sigma}\right)^{\beta}}\right]^{\alpha} \qquad ; x > 0$$

$$1 - e^{-(\frac{x}{\sigma})^{\beta}}$$

And has the probability density function (p.d.f)

$$f(x;\theta) = \frac{\alpha\beta}{\sigma}\left(\frac{x}{\sigma}\right)^{\beta-1} e^{-\left(\frac{x}{\sigma}\right)^{\beta}} \left[1 - e^{-\left(\frac{x}{\sigma}\right)^{\beta}}\right]^{\alpha} \qquad ; x > 0$$

The corresponding survival function is $\overline{H}(x) = 1 - F(x) = e^{-(\frac{x}{\sigma})^{\beta}}$

One is interested in an item for which there is a significant individual variation in ability to withstand shocks. There may be no practical way to inspect an individual item to determine its threshold y. in this case, the threshold must be a random variable. The shock survival probability are given by

$$P(X_i < Y) = \int_0^\infty g^*(x)\bar{H}(x)dx$$

$$= \int_0^\infty g^*(x)\left[e^{-\left(\frac{x}{\sigma}\right)^\beta}\right]dx = \left[g^*\left(\frac{x}{\sigma}\right)^\beta\right]^k$$

It may happen that successive shocks become increasingly effective in causing damage, even though they are independent. This means that $V_k(t)$, the distribution function of the kth damage is decreasing in k=1,2,… for each t. a renewal process is a counting process such that the time until the first event occurs has some distribution F, the time between the first and second event has, independently of the time of the first event, the same distribution F, and so on. When an event occurs, we say that a renewal has taken place. It is also known from renewal process that

$$P(T > t) = \sum_{k=0}^\infty V_k(t)\, P(X_i < Y)$$

$$L(t) = 1 - S(t)$$

Taking Laplace Transformation of L(T), we get

$$= 1 - \left\{\sum [F_k(t) - F_{k+1}(t)]\left[g^*\left(\frac{x}{\sigma}\right)^\beta\right]^k\right\}$$

$$l^*(S) = \frac{\left[1 - g^*\left(\frac{x}{\sigma}\right)^\beta\right] f^*(S}{\left[1 - g^*\left(\frac{x}{\sigma}\right)^\beta f^*(S)\right]}$$

$$= \frac{\left[1 - g^*\left(\frac{x}{\sigma}\right)^\beta\right]\left(\frac{c}{c+s}\right)}{\left[1 - g^*\left(\frac{x}{\sigma}\right)^\beta\left(\frac{c}{c+s}\right)\right]}$$

$$E(T) = \frac{d}{ds} l^*(S) \text{ given } s = 0 = \frac{1}{c\left[1 - g^*\left(\frac{x}{\sigma}\right)^\beta\right]}$$

$$E(T^2) = \frac{d^2}{ds^2} l^*(S)\ given\ s = 0 = \frac{2}{c^2\left[1 - g^*\left(\frac{x}{\sigma}\right)^{\beta}\right]^2}$$

$$g^*(.) \sim \exp(\mu)\,, g^*(\lambda) \sim exp\left(\frac{\mu}{\mu + \lambda}\right), \qquad g^*\left(\frac{x}{\sigma}\right)^{\beta} \sim exp\left(\frac{\mu}{\mu + \left(\frac{x}{\sigma}\right)^{\beta}}\right)$$

Then

$$E(T) = \frac{1}{c\left[1 - g^*\left(\frac{x}{\sigma}\right)^{\beta}\right]} = \frac{\mu\sigma^{\beta} + x^{\beta}}{c[\mu\sigma^{\beta} + x^{\beta} - \mu\sigma^{\beta}]}$$

$$E(T) = \frac{\mu\sigma^{\beta} + x^{\beta}}{cx^{\beta}}$$

$$E(T^2) = \frac{\left(\mu\sigma^{\beta} + x^{\beta}\right)^2}{c^2(x^{\beta})^2}$$

$$= \frac{\left(\mu\sigma^{\beta} + x^{\beta}\right)^2}{c^2x^{2\beta}}$$

$$V(T) = \frac{2\left(\mu\sigma^{\beta} + x^{\beta}\right)^2}{c^2x^{2\beta}} - \frac{\left(\mu\sigma^{\beta} + x^{\beta}\right)^2}{c^2x^{2\beta}} = \frac{\left(\mu\sigma^{\beta} + x^{\beta}\right)^2}{c^2x^{2\beta}}$$

Where,

μ – Stage I

σ – Stage II

β – Stage III

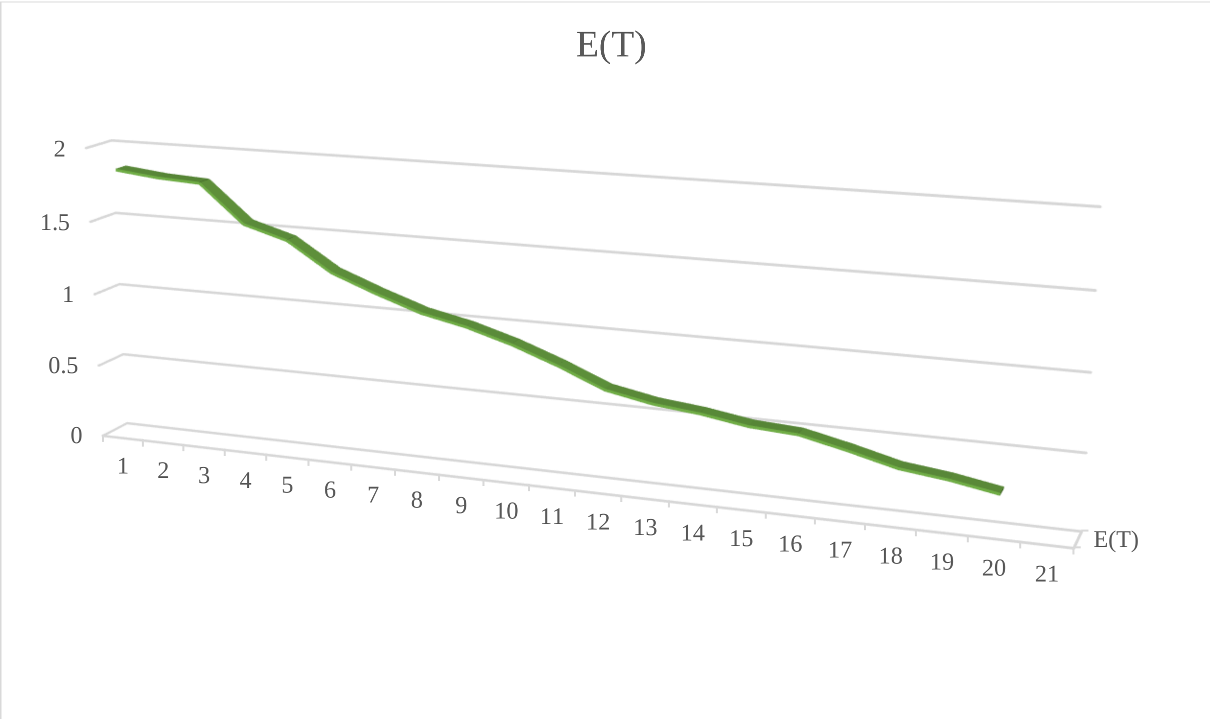
ϰ – Treatment after cell growth

c – Class interval

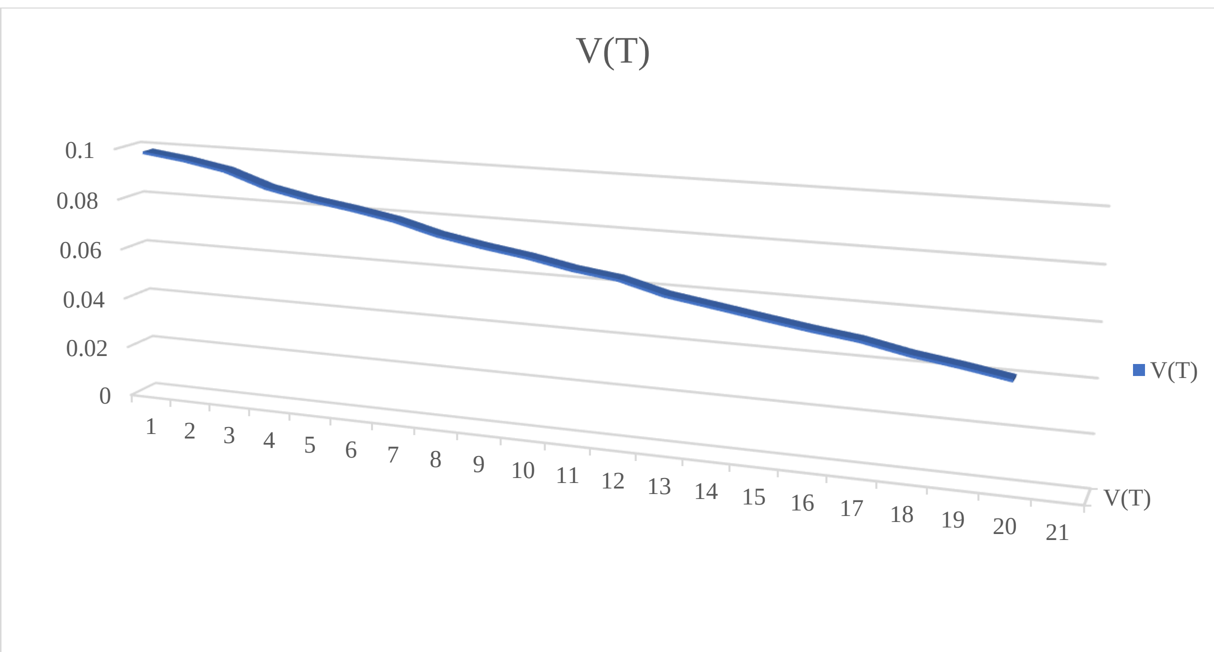
Table

c	μ	σ	β	ϰ	E(T)	V(T)
1	1979	2463	3926	972	1.8449	0.0982
2	1912	2238	3523	913	1.8123	0.0961
3	1891	2116	3411	872	1.7957	0.0931

Expected time for Stages and after treatment in smoking and drinking



Variancefor Stages and after treatment in smoking and drinking



4. CONCLUSION

When μ, β, x, σ is kept fixed the inter-arrival time 'c' which follows exponential distribution is an increasing parameter. Therefore the value of the expected time *E (T)* to cross the threshold of cancer patient is decreasing for all cases of the parameter values μ, β, x, σ. When the value of the parameter μ, β, x, σincreases the expected time is decreasing. This is indicated in pictures. The same case is observed in the result of cancer patient of the variance *V (T)* which is observed in Pictures. Using drinking, smoking in cancer patients life time is decreasing see above pictures in expected time.

5. *REFERENCES*

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