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Full Length Research Article

Comparative study of Aids Patients in four Regin by Using Stochastic Model

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ABSTRACT

All around the world persons living with HIV/AIDS faces many problems in their society. In this paper, the threshold of the HIV plays a major role in the progression of infection. The important characteristic of the threshold level of patients for a person is considered. The patients may dead when the total amount of antigenic diversity exceeds a threshold level. Mathematical model is obtained for the expected life time of AIDS PATIENTS by using Burr Type X distributions. The Data collected in four places namely Pondicherry, Trichy, Nanamakal and Coimbatore regions and fitted for this model.

Key words: Damage, Expected time, Shock model, Threshold.

INTRODUCTION

One of the most urgent public-health problems in developing countries is the AIDS epidemic, caused by the HIV. The dynamic transmission of HIV is quite complex and there is no other human infection which has the same epidemiological characteristics with a similar mode of transmission. For instance, the incubation period after infection with HIV is known to be extremely long and is measured in years rather than days. In populations who choose the time of their HIV tests, independence between dates of HIV infection and HIV testing cannot be assumed. Human immunodeficiency virus (HIV) infection is a worldwide problem and HIV/AIDS patients suffer from several opportunistic infections that occur because of poor immune system function. Poison distribution was first published in 1837. Pillai (Willcox, 1976) and Anil (Wodarz and Nowak, 2002) introduced the alpha-Poison distribution as a generalization of Poisson process.

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. Sexual contacts are the only source of HIV 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 seroconversion occurs and a person is recognized as an infected. The inter-arrival times between successive contacts, the sequence of damage and the threshold are mutually independent. Notations a discrete random variable denoting the amount of contribution to the threshold due to the HIV transmitted in discussed that any component or device when exposed to shocks which cause damage to the device or system is likely to fail when the total accumulated damage exceeds a level called the threshold**.** The three parameter generalized exponential (GE) distribution was introduced by Gupta and Kundu (1999). Recently the two parameter generalized exponential (GE) distribution has been proposed by the authors. It has been studied extensively by Gupta and Kundu (2001, 2005). The GE has a unimodal and right skewed density function. Mathematical model is obtained for the expected time of breakdown point to reach the threshold level through three parameter generalized exponential distributions. The spreading of HIV has taken different directions since the virus was first discovered, or more correctly, our perception of how and where HIV is spreading has changed over the years. Initially, men were infected to a greater extent than women but this has evened out and now women are identified as the most affected group together with youth and poor. Mathematical model is obtained for the expected time of breakdown point to reach the seroconversion threshold level. In the context of HIV/AIDS, the assumptions that the times between decision periods are independent and identically distributed (i.i.d) random variable.

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Assumptions of the model

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- The threshold of any individual is a random variable.

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- The inter-arrival times between successive contacts, the sequence of damage and the threshold are mutually independent.

Model description

The Cumulative density function (CDF) of the three-parameter generalized Exponential distribution

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

The corresponding survival function is

$$\bar{H}(x) = 1-\left[1-e^{-\lambda(x-\theta)}\right] \qquad \ldots\ldots\ldots\ldots (1)$$

$$= e^{-\lambda(x-\theta)} \qquad \ldots\ldots\ldots\ldots (2)$$

Y: Continuous random variable denoting the threshold level of generalized Exponential distribution.

$$P(X_i<Y) = \int_0^{\infty} g^*(x)\overline{H}(x)dx \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

S(t) : the survivor function i.e $P(T>t)$

$$P(T>t) = \sum_{k=0}^{\infty} V_k(t)P(X_i<Y) \qquad \ldots\ldots\ldots\ldots\ldots (4)$$

Taking Laplace Transformation of the life time $= 1-S(t)$ we get Let the random variable U denoting inter arrival time which follows exponential with parameter c.

Now $f^*(s) = \left(\frac{c}{c+s}\right)$, substituting in the above equation (5) we get

$$l^*(s) = \frac{[1-g^*(\lambda-\lambda\theta)]f^*(s)}{[1-g^*(\lambda-\lambda\theta)f^*(s)]} \qquad \ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

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

$$= \frac{c[1-g^*(\lambda-\lambda\theta)]}{[c+s-g^*(\lambda-\lambda\theta)c]} \qquad \ldots\ldots\ldots\ldots\ldots (6)$$

$E(T) = -\frac{d}{ds}l^*(s), given\ s=0$ now

Now,

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

$g^*(\lambda\theta)\sim \exp\left(\frac{\mu}{\mu+\lambda\theta}\right)$

$$E(T) = \frac{\mu^2+\mu\lambda\theta+\mu\lambda+\lambda^2\theta}{c[\mu^2+2\mu\lambda+\lambda^2\theta]}$$

Where

c=Time interval
μ = CD4 counts cell
λ= Viral RNA
θ= Total leucocyted count

Table 1. Pondichery region Data observed of the infected

C Time interval	μ CD4 counts cell	λViral RNA	θ Total leucocytes count
1	850	2760	3924
2	753	2110	3312
3	594	1950	2216
4	502	1281	1760
5	469	1012	1501
6	340	952	1292
7	290	812	1083
8	210	593	975
9	190	373	827
10	186	194	716

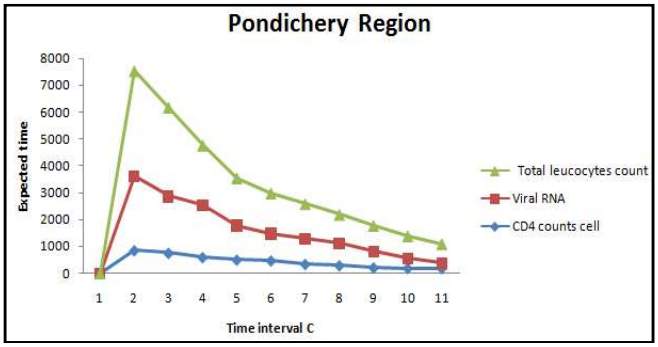


Table 2. Madurai region Data observed of the infected person

C Time interval	μ CD4 counts cell	λViral RNA	θ Total leucocytes count
1	809	2560	3824
2	703	2009	3411
3	564	1890	2132
4	486	1489	1680
5	433	1035	1601
6	326	840	1586
7	320	789	1398
8	272	561	1196
9	231	369	899
10	198	187	712

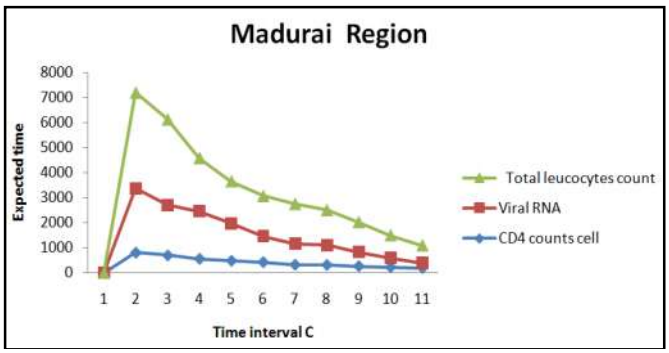


Table 3. Salam region Data observed of the infected person

C Time interval	μ CD4 counts cell	λViral RNA	θ Total leucocytes count
1	1106	2756	4124
2	954	2345	3755
3	859	2159	2519
4	753	1794	1978
5	610	1353	1701
6	534	1198	1614
7	493	976	1378
8	371	842	1645
9	359	657	712
10	198	190	618

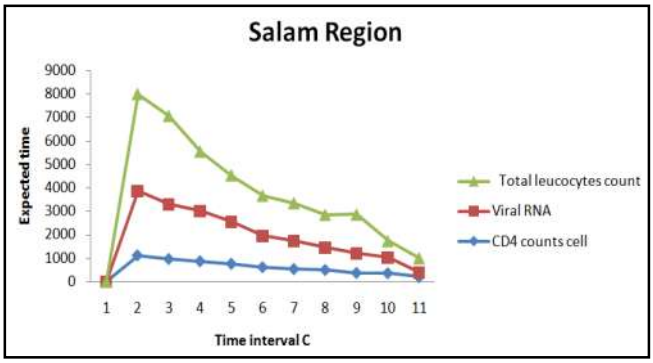
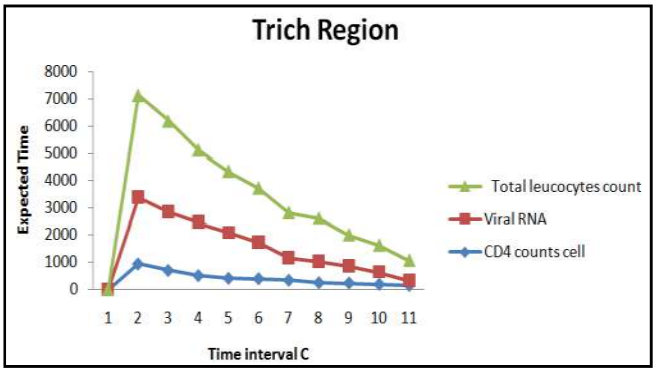


Table 4. TRICH region Data observed of the infected person

C Time interval	μ CD4 counts cell	λViral RNA	θ Total leucocytes count
1	945	2446	3741
2	706	2168	3316
3	516	1978	2648
4	415	1684	2246
5	405	1346	1980
6	346	842	1648
7	253	799	1578
8	242	642	1125
9	196	458	978
10	156	168	758

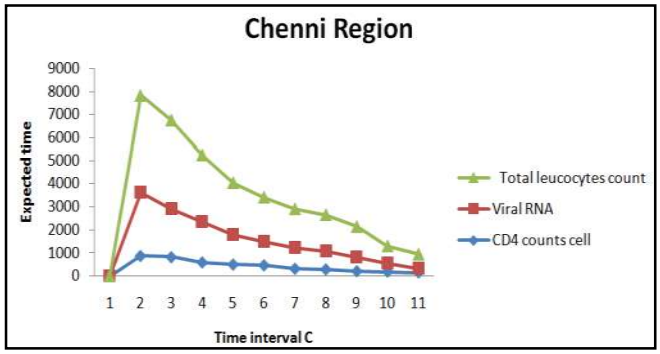


RESULTS AND CONCLUSION

In the study blood samples were collected from HIV positive individuals residing in Pondicherry, Madurai, Salem, Trichy and Chennai. The samples were analyzed for total leucocyte count, CD4 count and viral RNA load. At the time of sample collection individual from Salem was found to be the healthiest with greatest leucocyte and CD4 count. Whereas the infected person residing in Madurai had the least leucocyte and CD4 count, hence the unhealthiest.

Table 5. Chenniregion Data observed of the infected person

C Time interval	μ CD4 counts cell	λ Viral RNA	θ Total leucocytes count
1	875	2756	4214
2	823	2110	3845
3	594	1750	2914
4	502	1281	2278
5	469	1012	1945
6	320	922	1681
7	290	802	1573
8	210	599	1345
9	190	373	745
10	156	189	608



Stochastic model was applied to assess the progression of illness among the infected individuals. It revealed that whatever be the stage of illness at the initiation of treatment, when left untreated it progressed rapidly to advanced stage (CD4 less than 200). This emphasized the importance of early initiation of Anti-retroviral therapy to prevent the rapid progression of illness. The study recommends agencies involved in HIV control to start Anti-retroviral therapy immediately after confirmation of diagnosis to prevent the progression of illness.

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