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FUZZY LOG LOGISTIC DISTRIBUTION FOR HYPOTHROIDISM DEFICENT PATIENTS

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ABSTRACT. Modelling through mathematical is becoming a plentiful valuable tool for medical field. A mathematical model using fuzzy couple parameter log-logistic distribution, fuzzy survival and fuzzy hazard rate function and its α-cut sets were presented. In the paper we developed a mathematical pattern using the fuzzy log-logistic distribution for the effect of young women on hypothyroidism hormone.

1. INTRODUCTION

In human dependability analysis, human dependability is treated as a crisp value. Human conduct is influenced by numerous exhibition factors; for example, feeling of anxiety, task trouble, skill and competence level, task information and experience, work planning, work pressure, individual medical problems, aptitude level, and level of management. It is hard to appropriately figure out human dependability particularly in man-machine frameworks as both tangible and intangible factors play a part in it [2]. To conquer this trouble, the fuzzy set theory is applied to human dependability analysis. The statistical analysis of life time, survival time or failure time data is an important topic in many areas, including biological and social sciences [3]. A few techniques for managing lifetime information are very old; yet beginning around 1970 the field extended

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quickly concerning philosophy, hypothesis, theory and fields of utilization. Programming applications for lifetime information investigation have been broadly accessible since around 1980, with the incessant appearance of new highlights and packages. The failure rate of an item in the interval span $[t_1, t_2]$ is characterized as the likelihood of failure within time interval per unit time, given that it has outlasted up to time t_1. The hazard rate is the rate of failure at any moment of time.

Hypothyroidism is a danger factor for bone loss. Hypothyroidism hormone acts calcium levels in the blood, to a great extent by increasing the calcium level in the bloodstream when they are excessively low. It does this through its activities on the kidneys, digestive tract and bones. An age related increase in hypothyroidism hormone (HT) level has been given in various studies [1,2]. In both ladies and men, autonomous of progress in renal function, is related with an increase in incorporated HT secretary response to changes in serum calcium. The biological significance of these modest increments in incorporated intact hypothyroidism hormone (HT) levels during dynamic testing in older healthy men and women stay uncertain. Maximal bone mass is accomplished somewhere in the range of 30 and 45 years old, after bone loss occurs in both over a lifetime, women lose 60% of their trabecular bone mass and 30% of their compact bone mass, while men lose 72% of these sums [1,3,4]. In this paper, we study the fuzzy models to figure out the fuzzy survival and fuzzy hazard rate for the impact of young women hypothyroidism hormone dynamics utilizing using two parameter fuzzy log-logistic distributions.

2. Fuzzy Log-Logistic Distribution

The log-logistic distribution is a continuous probability distribution with numerous applications. The log logistic distribution can be utilized to model the lifetime of an item, the lifetime of a living being, or an assistance time. It is ordinarily utilized in statistical method for lifetime data and particularly valuable in modelling situations where the rate something is occurring increases at first, and afterward starts to decrease with respect to time. Among all statistical techniques it is preferred for analysis with smaller sample sizes than some other method [4,5]. A continuous random variable t with probability density function of log-logistic distribution is:

$$f(t,\lambda,\mu) = \frac{\left(\frac{\lambda}{\mu}\right)(t/\mu)^{\lambda-1}}{\left[1+(\lambda/\mu)^{\lambda}\right]^{2}}, t>0, \lambda>0, \mu>0.$$

The survival function for log logistic distribution is defined by:

$$S(t) = \left[1+(t/\mu)^{\lambda}\right]^{-1}.$$

The α-cuts of fuzzy survival function for log logistic distribution is:

$$\overline{S}(t) = \left\{\overline{S}_l(t), \overline{S}_u(t)\right\},$$

where

$$\overline{S}_\iota(t) = \min\left(1+\left(\frac{\overline{t}}{\overline{\mu}}\right)^{\overline{\lambda}}\right)^{-1} \quad \text{and} \quad \overline{S}_u(t) = \max\left(1+\left(\frac{\overline{t}}{\overline{\mu}}\right)^{\overline{\lambda}}\right)^{-1}.$$

Also the hazard function for log logistic distribution is defined by:

$$H(t) = \frac{\left(\frac{\lambda}{\mu}\right)\left(\frac{t}{\mu}\right)^{\lambda-1}}{1+\left(\frac{t}{\mu}\right)^{\lambda}}.$$

The α-cuts of fuzzy hazard function for the log logistic distribution is:

$$\overline{H}(t) = \{\overline{H}_\iota(t), \overline{H}_u(t)\},$$

where,

$$\overline{H}_\iota(t) = \min\frac{(\frac{\overline{\lambda}}{\overline{\mu}})(\frac{\overline{t}}{\overline{u}})^{\overline{\lambda}-1}}{1+(\frac{\overline{t}}{\overline{\mu}})^{\overline{\lambda}}} \quad \text{and} \quad \overline{H}_u(t) = \min\frac{(\frac{\overline{\lambda}}{\overline{\mu}})(\frac{\overline{t}}{\overline{u}})^{\overline{\lambda}-1}}{1+(\frac{\overline{t}}{\overline{\mu}})^{\overline{\lambda}}}.$$

3. Application

Consider the research work taken by Susan T. Haden et.al [2], and Kirubaharn D.R et.al [4,5] for the impact of age and gender on hypothyroidism hormone dynamics. Abnormalities in HT secretion play a significant job in bone loss and skin problem. In this manner, hyper secretion of HT may be relied upon to be more articulated in women than men. The maximal HT level was 25% higher in the older women than in the younger. The levels of serum intact hypothyroidism hormone acquired during the 70 minutes calcium infusion in young women were taken.

TABLE 1. Level of serum intact hyperthyroidism hormone by calcium in young women

Time(min)	0	10	20	30	40	50	60	70	80	90
(HT)(μg/I)	29	15	17	14	12	11	12	10	11	13

4. RESULTS

The scale and shape parameter of log-logistic distribution for table 2 are $\mu = 2.157, \lambda = 36.206$.

Let the corresponding fuzzy triangular numbers are:
$\overline{\mu} = [1.3709, 2.157, 3.0448]$ and
$\overline{\lambda} = [36.1152, 36.206, 37.1098]$.

The corresponding $\alpha - cut$ are given by:
$\overline{\mu} = [1.3709 + 0.7861\alpha, 3.0448 - 0.8878\alpha]$ and
$\overline{\lambda} = [36.1152 + 0.0908\alpha, 37.1098 - 0.9038\alpha]$.

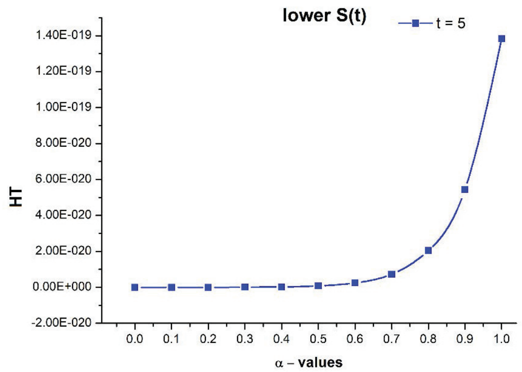

FIGURE 1. Fuzzy survival rate for lower alpha cut values

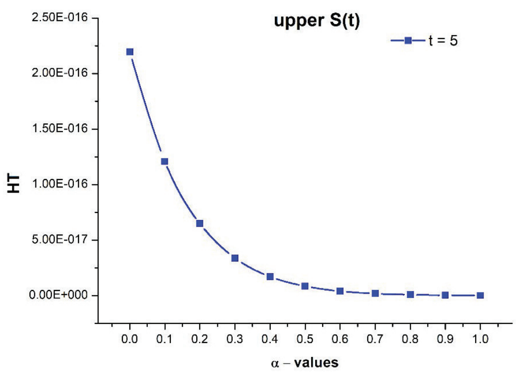

FIGURE 2. Fuzzy survival rate for upper alpha cut values

TABLE 2. Fuzzy survival rate for lower and upper alpha cut values

α	t	$low(\overline{\mu})$	$up(\overline{\mu})$	$low(\overline{\lambda})$	$up(\overline{\lambda})$	$\overline{S}_\iota(t)$	$\overline{S}_u(t)$
0	5	1.3709	3.0448	36.1152	37.1098	8.01897	2.19422
0.1	5	1.44951	2.95602	36.12428	37.01942	3.80566	1.20802
0.2	5	1.52812	2.86724	36.13336	36.92904	1.63379	6.48406
0.3	5	1.60673	2.77846	36.14244	36.83866	6.41156	3.38706
0.4	5	1.68534	2.68968	36.15152	36.74828	2.32076	1.71852
0.5	5	1.76395	2.6009	36.1606	36.6579	7.80813	8.45084
0.6	5	1.84256	2.51212	36.16968	36.56752	2.45825	4.01811
0.7	5	1.92117	2.42334	36.17876	36.47714	7.2846	1.84231
0.8	5	1.99978	2.33456	36.18784	36.38676	2.04229	8.12138
0.9	5	2.07839	2.24578	36.19692	36.29638	5.44164	3.43068
1	5	2.157	2.157	36.206	36.206	1.38353	1.38353

TABLE 3. Fuzzy hazard rate for lower and upper alpha cut values

α	t	$low(\overline{\mu})$	$up(\overline{\mu})$	$low(\overline{\lambda})$	$up(\overline{\lambda})$	$\overline{H}_\iota(t)$	$\overline{H}_u(t)$
0	5	1.3709	3.0448	36.1152	37.1098	4.06133	2.22542
0.1	5	1.44951	2.95602	36.12428	37.01942	1.42772	4.28474
0.2	5	1.52812	2.86724	36.13336	36.92904	4.0859	7.82103
0.3	5	1.60673	2.77846	36.14244	36.83866	9.72213	1.34851
0.4	5	1.68534	2.68968	36.15152	36.74828	1.9584	2.18759
0.5	5	1.76395	2.6009	36.1606	36.6579	3.39206	3.32421
0.6	5	1.84256	2.51212	36.16968	36.56752	5.12059	4.70876
0.7	5	1.92117	2.42334	36.17876	36.47714	6.81705	6.18402
0.8	5	1.99978	2.33456	36.18784	36.38676	8.08722	7.48453
0.9	5	2.07839	2.24578	36.19692	36.29638	8.62797	8.29196
1	5	2.157	2.157	36.206	36.206	8.3456	8.3456

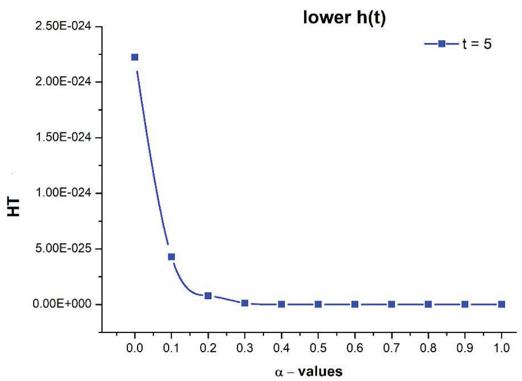

FIGURE 3. Fuzzy hazard rate for lower alpha cut values

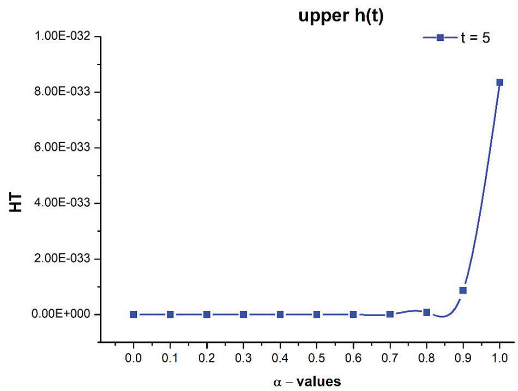

FIGURE 4. Fuzzy hazard rate for upper alpha cut values

5. CONCLUSION

Here we effectively settled the fuzzy models to determine the impact of women on hypothyroidism hormone dynamics by the gauge of fuzzy survival and fuzzy hazard function with two parameter fuzzy log-logistic distribution. The result shows that the fuzzy survival rate functions are increased in lower α-cuts and decreased in upper α-cuts and the fuzzy hazard rate functions are decreased in lower α-cuts and expanded in upper α-cuts. This shows that in the termination of testing, on the off chance that the fuzzy survival value increases, at that point the fuzzy hazard rate values decreases in the lower α-cuts and if the fuzzy survival rate value decreases then the fuzzy hazard rate value increases in the upper α-cuts for the impact of women on hypothyroidism hormone.

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