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Research Article

THE NEW GENERATOR FOR ODD-GENERALIZED EXPONENTIAL-GAMMA RAYLEIGH

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Abstract

The fundamental reason for statistical modeling is to identify the most appropriate techniques in transforming the distribution that adequately describes a dataset obtained from experiment, observational studies, surveys, and so on. Most of these techniques are based on finding the most suitable probability distribution that explains the underlying structure of the given data set. However, there is no single probability distribution that is suitable for different datasets. Thus, this has triggered the researchers to adopt and developed meaningful techniques in transforming the existing classical distributions or develop new ones. In this study Odukoya et al developed a generator using the concept of tahir et al techniques to transformed the combination of exponential-gamma developed by ogunwale et al (2019).the generator is called odukoye et al generator, which deal with input the hazard function of the newly developed distribution.

Keywords: Generator, Odd Generalized, Exponential-gamma, Odukoya et al techniques.

INTRODUCTION

In various fields, real-world data analysis has often demonstrated that classical distributions are insufficient for accurately modeling certain types of data. This realization has led to the development of extended distributions tailored to represent complex data patterns better. The focus has increasingly shifted towards innovative techniques for generating more meaningful and versatile distributions. Among these innovations, the creation of odd generalized classes of distributions has garnered significant attention in both theoretical and applied statistics. These techniques are valued for their flexibility and adaptability in capturing a wide range of data behaviors. These motivations often aim to explain the underlying mechanisms that generate the observed data more accurately. Over the years, numerous odd generalized families of distributions have been proposed and thoroughly studied, particularly for modeling lifetime data across various applications. Despite these advancements, many critical problems still involve real data that do not conform to widely use statistical models. Consequently, there is a growing need to expand existing families of distributions by introducing new shape parameters or modifying the existing ones to increase their applicability and effectiveness. The effectiveness of statistical analysis procedures is closely tied to the quality and appropriateness of the techniques employed. Recognizing this, considerable effort has been invested in developing new statistical models that can better handle the complexities of real-world data. This study contributes to this ongoing effort by transforming the Exponential-Gamma distribution developed by Ogunwale *et al.* (2019) into a novel odd generalized distribution. The odd Generalized Exponential-Gamma-Rayleigh distribution will be developed using the odd generalized techniques.

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By leveraging these techniques, the study aims to create a more flexible and robust distributional model capable of addressing the limitations of existing models and providing a better fit for complex data types. Although there are no suitable statistical distributions that can adequately describe such data, this has given rise to a continuous search for new probability distributions; in doing so, various researchers have adopted and developed multiple techniques for generating new statistical distributions that are more flexible. Therefore, in this study, we develop a new generalization known as the Odd Generalised Exponential-Gamma distribution arising from the transformation of the Exponential-Gamma distribution developed by Ogunwale *et al.* (2019) using the Odd generalized technique by introduce anewgenerator by replacing x with the odds $g(x)/[1-G(x)]$. (Odukoya *et al* generator) This generator has not being adopted by researcher where will have the probability density function /Survival function $g(x)/[1-G(x)]$ which is the same with Hazard function although many researchers have come up with generators, like Torabiand Montazeri (2012) used generator $G(x)/[1-G(x)]$ and proposed odd gamma generalized family from the log it of gamma distribution. Bourguignon et al. (2014) also used generator $G(x)/[1-G(x)]$ and introduced *Weibull-G* family of distribution from Weibull distribution logit. Zografos and Balakrishnan (2009) proposed *gamma-G* family using generator$-\log[1-G(x)]$. Ristic´ and Balakrishnan (2012) introduced another *gamma-G* family from generator $-\log[G(x)]$. Amini et al. (2012) introduced two *log-gamma-G* families from generators $-\log[1 - G(x)]$ and $-\log[G(x)]$ with motivation to upper and lower records. In this study will used Odukoya et al generator of (2024)

$$\frac{g(x)}{1-G(x)} = \frac{g(x)}{\bar{G}(x)} = h\left(x\right)$$

And this generator is known as odukoya et al (2025) generator techniques

We developed a new generalized distribution referred to as the Odd generalized exponential gamma (OGEGD) distribution using Odukoya et al generator (2025) the proposed distribution is the transforming exponential gamma developed by Ogunwale *et al.* (2019). In the study we introduce anewgenerator to transform Odd Generalized exponential-gamma (OGEGD). Odukoya *et al.* (2025) used generator $g(x)/[1-G(x)]$ which is developed by the researchers

METHODOLOGY

This study will develop a new probability model named the Odd Generalized Exponential-Gamma Distribution using new generator known as Odukoya et al generator. The statistical derivation of generator is illustrated below distribution:

The generalization of the odd generalized exponential-gamma distribution

Theorem 1

Let X be a continuous independent random variable such that $X_1 \sim EGD(x,\beta,)$ and let $f(x)$, and $F(x)$ be the probability density function, cumulative density function of Exponential-Gamma distribution given as

$$f(x)=\frac{\beta^{\theta+1}x^{\theta-1}e^{-2\beta x}}{\Gamma(\theta)} \quad x,>0,\beta>0,\theta>0,\sigma>0 \tag{1}$$

$$F(x)=\frac{\beta\gamma(\alpha,x)}{2^{\alpha}\Gamma(\alpha)} \quad \lambda>0,\alpha>0,x>0 \tag{2}$$

$$h(x)=\frac{\beta^{\theta+1}x^{\theta-1}e^{-2\beta x}2^{\theta}}{2^{\theta}\Gamma(\theta)-\beta\gamma(\theta,x)} \tag{3}$$

EGD developed by Ogunwale *et al* (2019)

Similarly, the pdf of OGED developed by Tahir *et al*. (2015) is given as

$$f(x)=f(x,\sigma,\theta,\beta,\varepsilon)=\frac{\beta\theta G(x,G)}{\bar{G}(x,\varepsilon)}exp\frac{\theta G(x,\varepsilon)}{\bar{G}(x,\varepsilon)}(1-exp\frac{-\beta G(x,\varepsilon)}{G(x,\varepsilon)})^{\theta-1} \tag{4}$$

Where;

$g(x)$ is the probability density function of the prior distribution

$G(x)=$ Cumulative density function of the prior Distribution

$\bar{G}(x)=1-G(x)$ is the survival function of the prior distribution

Using the techniques above, the hazard function of exponential-gamma distribution is then given as

Using the techniques above, the hazard function of exponential-gamma distribution is then given as

$$\frac{g(x)}{1-G(x)}=h(x) \tag{5}$$

Note that the hazard function formula is

$$\frac{g(x)}{1-G(x)}=\frac{g(x)}{\bar{G}(x)}$$

The EGD proposed by Ogunwale *et al*. (2019) will be transformed into Odd generalised exponential gamma distribution using *Odukoya generator techiques*. (2025) techniques.

The pdf of OGEGD is given by inserting equations (5) into equation (1) above then the pdf is defined as;

$$f(x)=\frac{\beta^{\theta-1}}{\Gamma(\theta)}\left(\frac{g(x)}{\bar{G}(x)}\right)^{\theta-1}e^{-2\beta g(x)/\bar{G}(x)} \quad x>0,\theta>0,\beta>0, \tag{6}$$

Conclusion

The focus has increasingly shifted towards innovative techniques for generating more meaningful and versatile distributions. Among these innovations, the creation of odd generalized classes of distributions has garnered significant attention in both theoretical and applied statistics. These techniques are valued for their flexibility and adaptability in capturing a wide range of data behaviors and new generator was developed by odukoya et al which deal with inserting the hazard function into the probability density function of exponential gamma, which now transform the distribution into an odd form

$$=\frac{g(x)}{\bar{G}(x)},$$

Probability density function /survival function in which any distribution can now use the generator.

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