SURVIVAL ANALYSIS OF AVERAGE TIME TO JUSTICE DELIVERY IN THE NORTHERN REGION OF GHANA

ENOCH DEYAKA MWINI[1,*], WINNIE MOKEIRA ONSONGO[2], ALFRED ASIWOME ADU[3]

[1]Department of Mathematics and Computer Studies, Tamale College of Education, Ghana

[2]Department of Statistics and Actuarial Science, University of Ghana, Legon, Ghana

[3]Department of Business Studies, Lancaster University, Ghana

Abstract. In this study, survival analysis was used to determine the mean time to justice delivery in the District, Circuit and High courts in Tamale Metropolis of the Northern Region of Ghana. Three main models, namely; Kaplan-Meier estimator, Cox regression, and gamma distribution were utilized in the analysis to explore all useful information that can help policy makers and stakeholders in minimizing delays in justice delivery in the law courts. Results produced by the parametric probability distributions were similar to those of the semi-parametric, Cox regression model. Of the independent variables under consideration, four of them i.e sex of the accused, number of subsequent hearings of a case, type of court handling the case, and the type/nature of case were found to contribute significantly to the mean time to justice delivery. Moreover, it was observed that, males constituted 76.7% of the accused persons and 23.3% females for both criminal and civil cases. Also, it was evident from the study that cases terminated faster in the Circuit and High courts as compared to the District court. Finally, it was found that civil cases tend to have shorter life spans than criminal cases.

---

*Corresponding author

E-mail address: nokyman77@gmail.com

1. INTRODUCTION

Under the auspices of The Judiciary (The 1992 constitution of the Republic of Ghana), it is the civic right of every citizen of the Republic of Ghana to be given a fair hearing with a reasonable time frame by the courts in the event of one being charged with a criminal offence. However, one of the main concerns is that Ghana's justice delivery system has failed to meet people's expectations on prompt delivery of justice [1]. This delay is in fact one of the greatest challenges before the judiciary towards which every effort is being made to improve. Here, delay in context of justice denotes the time consumed in the disposal of a case, in excess of the time within which a case can be reasonably expected to be decided by the court.

An expected life span of a case is an inherent part of the judiciary system. However, difficulty arises when the actual time taken for disposal of the case far exceeds its expected life span hence delay in the dispensation of justice. This delay in disposal of cases does not only create disillusionment among the litigants, but also undermines the very capability of the system to impart justice in an efficient and effective manner. Long delay also has the effect of defeating justice in quite a number of cases [2].

[3] reported that there were over 30 million cases pending in various courts in India with average time span of about 15 years. This scenario is not unique to India but in our own part of the world as well. It therefore prompts us to investigate the mean time of justice delivery in the law court to help review and enhance the judicial reforms in justice delivery system.

A number of studies have been carried out on justice delivery around the globe. In his study on judicial reforms in justice delivery system[4] concluded that failure of the judiciary to deliver within a time frame leads to a sense of frustration among lawyers and litigants.

[5] predicted the performance of survival models using survival analysis. The prediction accuracy is quantified by performance measures, that are based on loss functions. He studied the estimators of these performance measures, the prediction error and performance scores, for point and probabilistic predictors, respectively.

The focus of this work is to assess the prediction performance of survival models that analyze censored survival times. [6] used survival analysis to study Sentence Length and Recidivism: Are Longer Incarcerations the Solution to High Rates of Reoffending? This study analyzed

the implications of sentence length on recidivism when controlling for type of crime, length of sentence, sex, race and age.

[1] in their study used survival analysis to determine the average time to justice delivery in law courts for the Upper East and Upper West regions of Ghana. The study revealed that the average time to justice delivery was 103 days. Four major factors were found to contribute significantly to the average time to justice delivery. These were; the type of court handling the case, the type or nature of case, the occupation of the accused and the number of subsequent hearings. It was evident from the study that cases terminated faster in Upper East courts as compared to the Upper West courts.

Moreover [12], [15], [13] and [14] developed nonparametric approaches, with the aid of a bias correction tool, for estimating the finite population parameters. The estimators of finite population mean in [12] and [15] can be utilized in the determination of the average number of civil and criminal cases that are handled at any of the levels of judiciary. Using the data collected, estimators in [13] and [14] are useful in determining the crime incidence and prevalence rate. These approaches are useful in that they allow incorporation of auxiliary variables in the estimation process hence giving rise to more efficient estimates of the population characteristic of interest. The developed estimators solve the bias-variance trade-off problem that mostly arises in other nonparameteric estimation procedures.

Based on the assumption that quick resolution of civil and criminal cases is an important social goal, inextricably linked to human rights, part of this study attempts to disprove the legal fallacy that, it is undesirable for courts to operate with speed. In this regard the objectives of this study are to determine the average time to justice delivery using a statistical approach, determine if the type of case or court affect the time it takes for a sentence to be passed and also establish which variables contribute significantly to the survival rate of cases and finally model the average time to justice delivery using the semi-parametric and parametric models :

1.1. Ghanaian Legal System: An Overview. The Ghana legal system is hierarchical in structure with five levels of courts: District courts, circuit courts, High Court, Court of Appeal, and Supreme Court. Within this 5-rung ladder a 3-tiered appeal system exists , from the

lower courts to the High Court, from the High Court to the Court of Appeal, and from the Court of Appeal to the Supreme Court [7, 1].
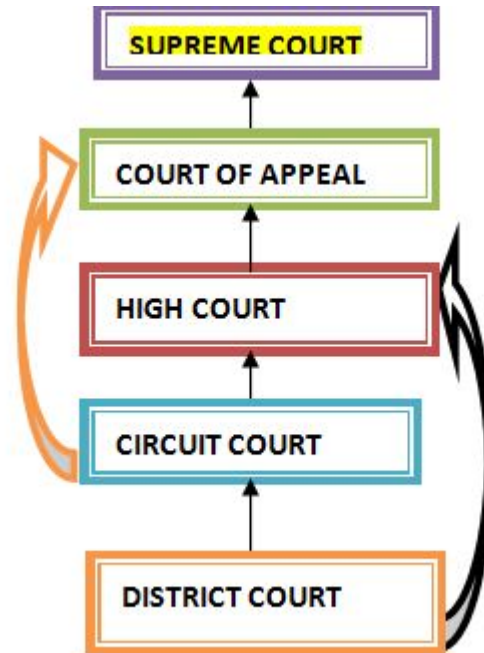

FIGURE 1. The Ghanaian Legal System

The Supreme Court is the highest court on the land and has power as the highest authority to interpret the Constitution and shall have final authority to say what the law is including determining whether any acts of Parliament or the President is in violation with the Constitution. It also looks into and handles appeal cases from the court of appeal and constitutional reviews.

The Court of Appeal has the mandate to hear appeals from any judgment of a Circuit Court in a civil case and in any matter in which jurisdiction is conferred on the Court under any other enactment. It is usually presided over by three judges and handles appeal cases from the High court Judicial Service of Ghana [7].

The High Court has jurisdiction in all matters, civil and criminal, other than those involving treason. It has the power to enforce the Fundamental Human Rights and Freedoms under the Constitution. The Fast Track Court is another type of the high court that is a fully automated. As such, it is well stocked with computers, speech and sound devices that enables it to fast track judgment.

The Circuit Court This is not an appellate but it has the judicial mandate to take withdrawn cases. It is usually presided over by a judge and has an original jurisdiction in all matters.

The District Court is also known as the magistrate court and has its jurisdiction limited to minor cases. These are usually presided over by magistrates.

2. METHODS

2.0.1. *Data Source and Description.* Purposive sampling was used in the Tamale District, Circuit, and High courts. Secondary data on ten variables; date1 (the date the case was first reported or an arrest was made or the writ was filed), age, sex, religion, occupation, date2 (the date the case was first heard in court), subsequent hearing (the total number of adjournments), date3 (the date of last hearing to time or the date the sentence is passed) and remark, were obtained on the cases handled by these courts for the year, 2013[2].

Data was obtained on the civil and criminal cases, where the criminal cases are categorized into first degree felony, second degree felony and misdemeanor. The data entry and preliminary analysis were done using the statistical software package for social scientist (SPSS) version 16.10. Further analysis was then done using SAS version 9.1.

The objective is to provide an estimate for the average time to justice delivery and also determine the survival and hazard rates of cases reported at the Tamale Metropolitan courts. Data based on the 2010 Population and Housing Census (PHC) showed that the total population of Northern Region as at 26th September, 2010 was 2,479,461. which is a 36.2% increase over the 2000 population figure of 1,820,806. The data revealed that there were 1,249,574 females and 1,229,887 males as at 26th September, 2010 [8].

2.0.2. *The Study Variables.* The study considered justice delivered the moment judgment is pronounced by the judge. Hence though justice delivery may depend on so many factors both measurable like age sex religion and so on and immeasurable factors (human factors) examples are delays due to unavailability of evidence, delay due to counsellors and judges being indisposed, and even sometimes judicial breaks. The study only took into consideration the measurable variables and built a model based on these variables. These variables were; date1,

age, sex, religion, occupation, date2, number of subsequent hearings (SUBH), date3 duration1, duration2, duration3 and remark.

2.0.3. *Survival Analysis.* Survival analysis is a class of statistical methods for studying the occurrence and timing of events. For example: time to die from disease say cancer, time to first marriage, time to promotion to next position, time to earthquake etc. This particular field of study is extremely useful for studying many different kinds of events in both social and natural sciences [9].

The standard approach to survival analysis is probabilistic or stochastic [10]. Thus, the times at which events occur (survival times) are assumed to be realizations of some random process. It follows that T, the event time for some particular individual, is a random variable having a probability distribution.

A survival function gives the probability of surviving or being event-free beyond time t. it is given by;

$S(t) = Pr($an individual survives longer than $t)$

(1) $$S(t) = Pr(T > t) = 1 - F(t)$$

where, $F(t) = Pr($an individual fails before $t)$

In this work, the Kaplan-Meier approach is used to determine the average time to justice delivery which is then modelled using the Cox-Regression and Parametric models.

Estimation of the survival function

Kaplan-Meier (KM) method also known as the product-limit estimator is the most widely used method for estimating survivor functions and is more suitable for smaller data sets. It is a non-parametric method used to estimate the survivorship function using conditional probability. The Kaplan-Meier estimator of the survival function, $S(t)$ is denoted by;

$\hat{S}_{KM}(t) = \prod_{i=1}^{j}(1 - d_j/r_j)$

The Cox's Proportional Hazard Model

The Cox Proportional Hazard (assuming hazard is constant for all cases) model is a semi-parametric model in which the hazard function of the survival time is given by;

$$(2) \qquad \lambda_i(t,x) = \lambda_0(t)e^{\beta_i x_i(t)}$$

where $i = 1, 2, \cdots, n$.

Taking the natural logarithm (log_e) of both sides of equation (2), the model can be rewritten as;

$$(3) \qquad \log \lambda(t) = \log \lambda_0(t) + \beta_1 x_{i1} + \beta_2 x_{i2} + \cdots + \beta_k x_{ik}$$

where $\lambda_0(t)$ is an unspecified baseline hazard function, $x(t)$ is a vector of time-dependent co-variate values, β is a $k \times 1$ vector of unknown regression parameters, and n is the number of variables.

Taking survival time as the dependent variable and age, sex, religion, occupation, number of subsequent hearings, type of court, and type of case as independent prognostic factors, and based on the fact that the ratio of the hazards for any two cases i and j is constant over time the expected model will assume the form:

$$(4) \qquad h(t,x) = (\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7)$$

Where the β_i's are estimated coefficients of the regression model such that,

$\beta_0 = \log \lambda_0(t)$, is the baseline constant for the regression model

x_1 = Age of the accused, x_2 = sex of the accused, x_3 = religion of the accused, x_4 = occupation of the accused, x_5 = number of subsequent hearings of the case, x_6 = nature/type of case and x_7 = type of court handling the case

Parametric Regression Models

The method of maximum likelihood is used to estimate parametric regression models with censored survival data [11]. It accommodates all types of censoring data. It is a linear regression model given by:

The model utilized is given as;

$$(5) \qquad \log T_i = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_k x_{ik} + \sigma \varepsilon_i$$

Where ε_i is a random disturbance term, and $\beta_0, \cdots, \beta_k$ and σ are parameters to be estimated.

3. DATA ANALYSIS AND DISCUSSION

Various statistical tools were used in analysing the data. This work presents a brief descriptive analysis of the raw data summarized in tables 1, 2 and 3. The main results were achieved by the Kaplan-Meier (product limit) approach, Cox regression model, and parametric modelling which considered: exponential, gamma, normal, log normal, log-logistic and Weibull models based on a 5% level of statistical significance.

The distribution ,by type of court, of the study sample are shown in Table 1 below. Of the accused persons, the males constituted 76.7% with a modal age group of 18-60 years. On the other hand, 23.3% were females implying that the crime rate of females is far low than males in the Northern Region of Ghana. This could be as a result of cultural and religious expectations on the part of the female population. Majority (90.5%) of the cases was closed but of the closed cases 24.4% were from the District court, 31.9% from Circuit court and 43.8% from the High court. On the whole 9.5% of the cases were either pending or withdrawn. Even though the District court recorded the least number of cases of 24.4% it relatively had the highest survival time of 182 days.

TABLE 1. Frequency Distributions by Type of Court

| | | Type of Court | | | | | | Total | |
| | | District | | Circuit | | High | | | |
		No.	(%)	No.	(%)	No.	(%)	No.	(%)
Sex	Male	79	25.5	111	36.3	116	37.9	306	76.7
	Female	22	23.7	18	19.4	53	57.0	93	23.3
	Total	101	25.3	129	32.3	169	42.4	399	100
Age	< 18	7.0	46.7	4.0	26.7	4.0	26.7	15	3.8
	18 – 60	92	24.6	121	32.4	161	43.0	374	93.7
	>60	2.0	20	4.0	40	4.0	40.0	10	2.5
	Total	101	25.3	129	32.3	169	42.4	399	100
Religion	Christian	37	23	54	33.5	70	43.5	161	40.4
	Muslim	56	27.7	66	32.7	80	39.6	202	50.6
	Others	8.0	22.2	9.0	25	19	52.8	36	9.0
	Total	101	25.3	129	32.3	169	42.4	399	100
Remark	Closed	88	24.4	115	31.9	158	43.8	361	90.5
	Pending/ With-drawn	13	34.2	14	36.8	11	28.9	38	9.5
	Total	101	25.3	129	32.3	169	42.4	399	100
Occupation	Civil & Public	13	16.3	34	42.4	33	41.3	80	20
	Trader/Art. Driv./Farmer	73	29.7	75	28.4	98	39.8	246	61.7
	Unemployed	10	22.7	8.0	18..2	26	59	44	11
	Other	5.0	17.2	12	41.4	12	41.4	29	7.3
	Total	101	25.3	129	32.3	169	42.4	399	100

Table 2 below also displays a cross tabulation of sex with the other variables. It was observed that 54.9% of the total number of cases were criminal in nature. Of the accused persons, 82.6% were males. Of the remaining 45.1% civil cases, 30.6% of the accused were females. Among the various courts, the District court recorded a low number of cases followed by Circuit court and the High court. It was noted that the crime rate among Muslim men was higher with a

percentage of 81.2 compared to respondents in the Christian and other religions. Respondents, who were drivers, artisan, traders, or farmers, recorded the higher number of cases with a percentage of 61.7. Others, which may include house wives, students and so on recorded 7.0% as the lowest number cases sampled.

TABLE 2. Frequency Distributions by Sex

		SEX				Total (%)	
		Male	(%)	Female	(%)	No.	(%)
Type of case	Civil	125	69.4	55	30.6	180	45.1
	Criminal	181	82.6	38	17.4	219	54.9
	Total	306	76.7	93	23.3	399	100
Type of Court	District	79	78.2	22	21.8	101	25.3
	Circuit	111	86.0	18	14	129	32.3
	High	116	68.6	53	31.4	169	42.4
	Total	306	76.7	93	23.3	399	100
Age	< 18	12	80	3.0	20	15	3.8
	18-60	289	76.7	87	23.3	374	93.7
	> 60	7.0	70	3.0	30	10	2.5
	Total	306	76.7	93	23.3	399	100
Religion	Christian	114	70.8	47	29.3	161	40.4
	Muslim	164	81.2	38	18.8	202	50.6
	Others	28	77.8	8.0	22.2	36	9.0
	Total	306	76.7	93	23.3	399	100
Occupation	Civil/Public	56	70	24	30	80	20
	Trader/Art. Driv./Farmer	207	84.1	39	15.9	246	61.7
	Unemployed	27	61.4	17	38.6	44	11
	Other	15	53.6	13	46.4	28	7.0
	Total	306	76.7	93	23.3	399	100
Remark	Closed	276	76.5	85	23.5	361	90.5
	Pending/ Withdrawn	30	78.9	8.0	21.1	38	9.5
	Total	306	76.7	93	23.3	399	100

TABLE 3. Frequency Distributions by Type of Case

		Type of Case					
		Civil	(%)	Criminal	(%)	**Total**	(%)
Age	< 18	6.0	40.0	9.0	60	15	3.8
	18-60	168	44.9	206	55.1	374	93.7
	> 60	6.0	60	4.0	40	10	2.5
	Total	180	45.1	219	54.9	399	100
Religion	Christian	76	47.2	85	52.8	161	40.4
	Muslim	85	42.1	117	57.9	202	50.6
	Others	19	52.8	17	47.2	36	9.0
	Total	180	45.1	219	54.9	399	100
	Civil/Public	43	53.8	37	46.2	80	20.1
Occupation	Trader/Art.	102	41.5	144	58.5	246	61.7
	Driv./Farmer						
	Unemployed	24	54.5	20	45.5	44	11
	Other	11	39.3	17	60.7	28	7.0
	Total	180	45.1	219	54.9	399	100
Sex	Male	125	40.8	181	59.2	306	76.7
	Female	55	59.1	38	40.9	93	23.3
	Total	180	45.1	219	54.9	399	100
Type of Court	District	39	38.6	62	61.4	101	25.3
	Circuit	61	47.3	68	52.7	129	32.3
	High	80	47.3	89	52.7	169	42.4
	Total	180	45.1	219	54.9	399	100

Generally, criminal cases constituted 54.9% and civil cases 45.1% of the entire data as shown in Table 4.3 above. The age bracket that had most of the criminal and civil cases was between 18 and 60 years. Most of the juvenile cases were criminal in nature. A good proportion (60%) of the cases against the accused within the pensionable age (60+) was civil in nature. Most of the cases handled by the high court was closed and hence not censored.

3.1. Estimation of the Survival Time to Justice Delivery using the Kaplan-Meier (product limit) approach. The Kaplan-Meier (KM)approach yielded estimates of the probability of survival of the observations at particular points in time. The output of the SPSS statements gave a summary statistics on quartile estimates and survival functions on the average time to justice delivery.

TABLE 4. Summary of Time from the start of a case to finish for the entire data

Quartile Estimates			
Percent	Point Estimate	95% Confidence interval	
		lower	Upper
75	198	183	213
50	130	119	141
25	55	43	65
Mean		Standard Error	
163		5.838	

Table 4 gives the summary statistics of the time variable duration, which is the time interval from arrest to sentencing for the whole data. The 25th percentile which is the smallest event time for which the probability of judgment been passed earlier, is greater than 0.25 for this data, is 55 days. The 75th percentile is 198 days and the 50th percentile which is also the same as the median judgment time is, 130 days. The median is 130 days with a 95% confidence interval of 119 to 141 days. The estimated mean is 163 days and as noted on the output the mean is biased since there are censoring times greater than the largest event time. Hence the preferred measure of central tendency of this data is the median. Thus the average time to justice delivery for this data holding all variables constant is 130 days.

Fig. 2 below shows the survival distributions for the entire data. The basic survival curve is a visual display of the model-predicted time to justice delivery for the average respondent. The horizontal axis shows the time to justice delivery and the vertical axis shows the probability of survival. Any point on the survival curve shows that a case in a given type of court will remain in the court past that time.
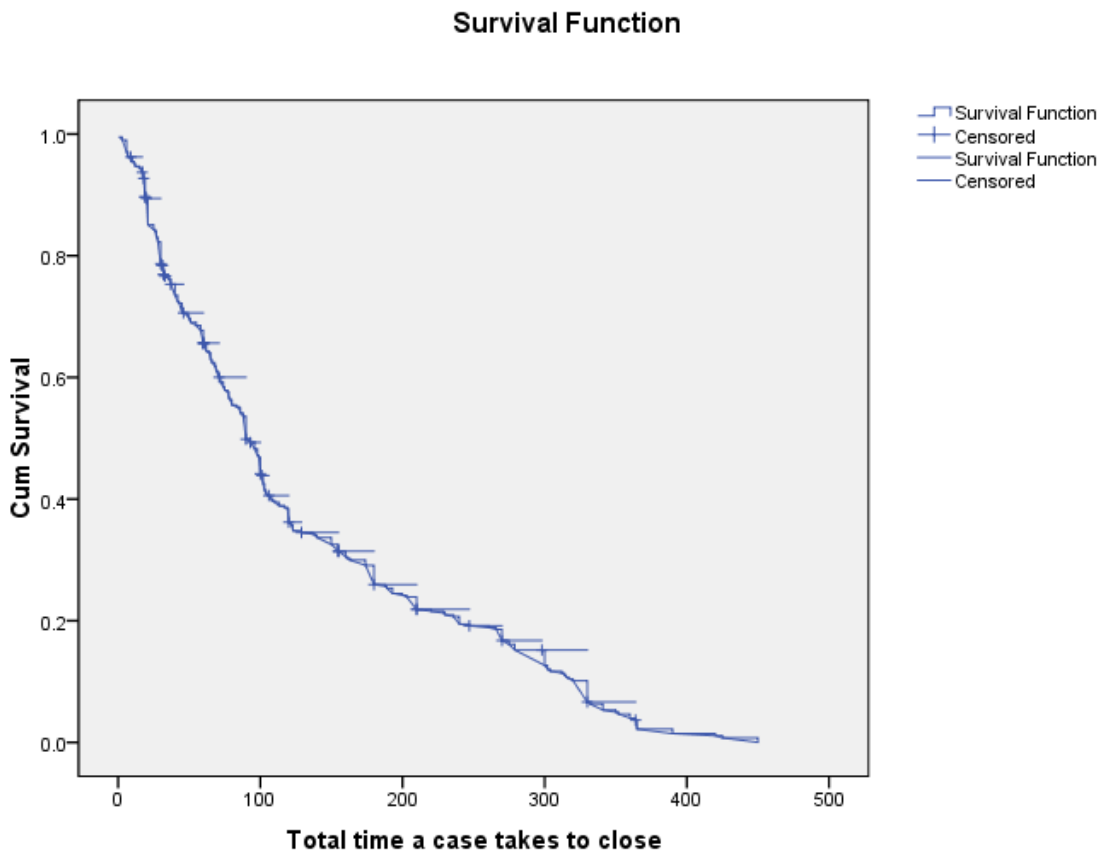
Survival Function

FIGURE 2. Plot of the survivor function for average time to justice delivery for the entire data

3.2. Analysis on Whether the Nature of Case Affect the Survival Time to Justice Delivery.
Quartiles estimates on the survival times, the overall survival function for the various cases and some test statistics were used to determine whether the nature of case affect the time a case be concluded.

TABLE 5. Summary Statistics of Time from the start of a case to finish for the types of cases.

Quartile Estimates						
Percent	Civil Cases			Criminal Cases		
	Point Est.	95% C. I.		Point Est.	95% C. I.	
		Lower	Upper		lower	upper
75	157	123	191	220	186	253
50	120	78	155	138	127	193
25	78	56	103	55	43	65
Mean		Standard Error		Mean	Standard Error	
135.24		8.14		161.5	8.23	

Table 5 gives the summary statistics for the time variable duration, for types of cases (civil and criminal cases). The 25th percentile for civil cases is 78 days whilst that for criminal cases is 55 days. The 75th percentile for criminal cases is 220 days whilst that of civil cases 157 days. The 50th percentile and hence the average time to justice delivery for civil cases is 120 days whilst that for criminal cases is 138 days. The mean duration for the civil and criminal cases were reported as 135 and 161 days respectively.

The survival curves in Fig 3 below, give a visual representation of the life tables. The horizontal axis for the function shows the time to event, in this regard, the time to adjudication of a civil or a criminal case. In this plot, drops in the survival curve occur when the cases taken to court are adjudicated. The trend clearly indicates that criminal cases with a more gradual survival curve take longer time to receive judgment than civil cases.
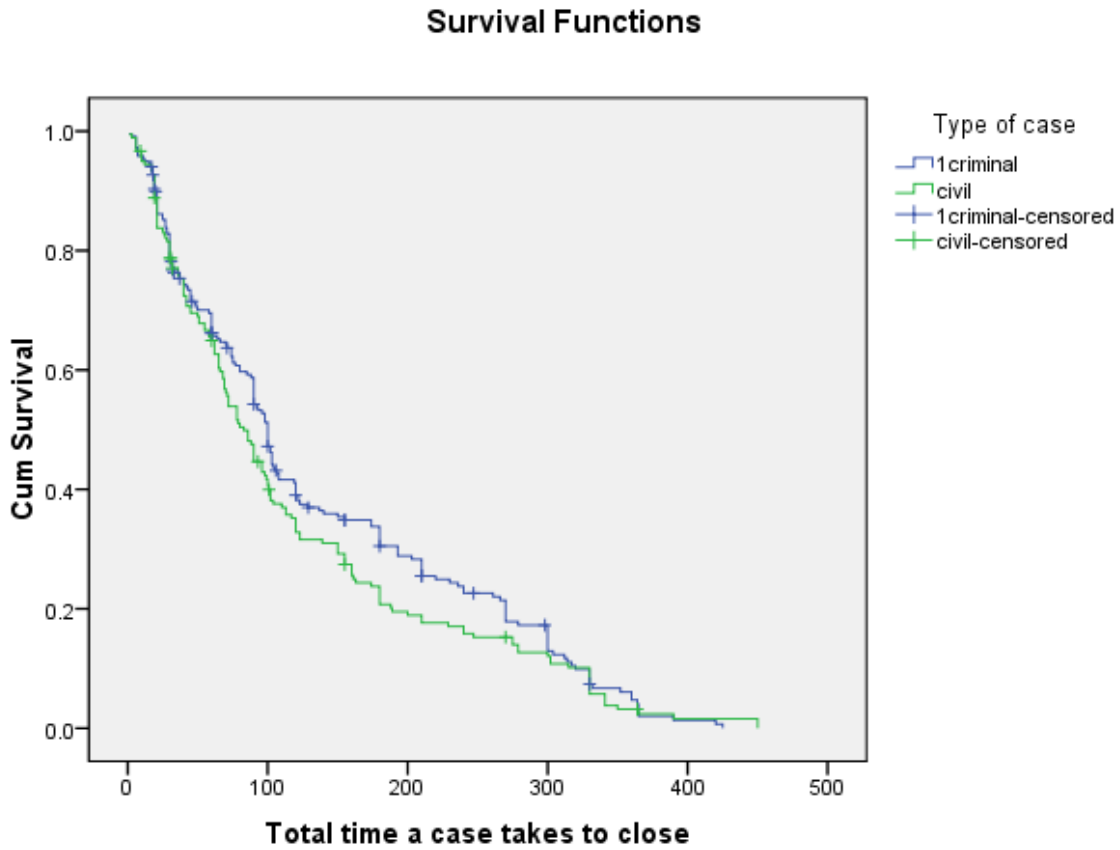
FIGURE 3. Plot of survival function for type/nature of cases

3.3. Survivor Functions for Average Time to Justice Delivery for the Type of Cases against Courts. Fig 4 below gives a plot of survival function for the average time to justice delivery of the types of cases against types of courts. It is visually clear from the graph that civil cases terminate faster in the Circuit court than the District and High courts respectively.
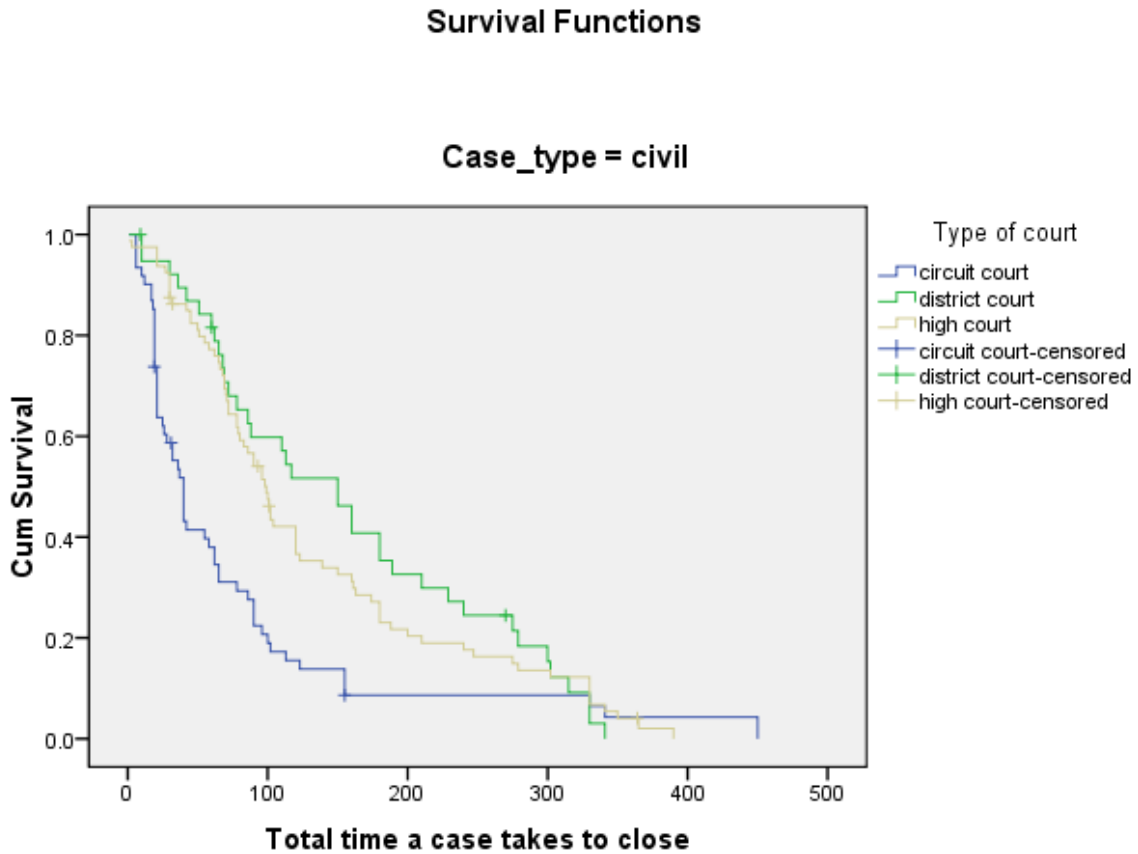
FIGURE 4. Plot of the survivor function for average time to justice delivery for the type of cases against courts.

The survival curve in fig 5 below gives a visual representation of the of survival times of criminal cases in the different types of courts. The time to adjudication of criminal cases is faster in the circuit court than the District and High courts. The average time to justice delivery of criminal cases are; 198 days in the District court, 55 days in Circuit court and 155 days in the High court.
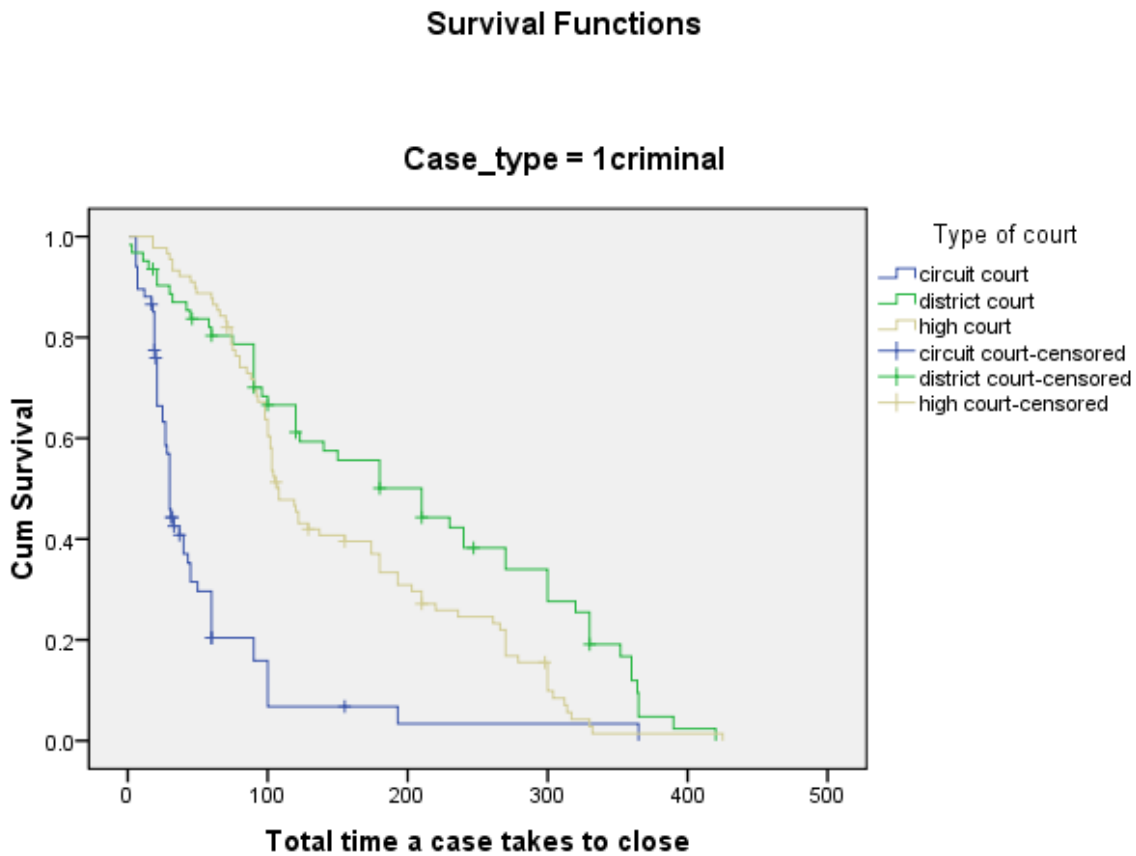
FIGURE 5. Plot of the survivor function for average time to justice delivery for the type of cases against courts.

Generally, both civil and criminal cases terminate faster in the Circuit court, followed by the High court and the District court respectively.

TABLE 6. Test of Equality of survival distributions for the different levels of type of cases in the courts

Overall Comparisons

	Chi-Square	Df	Sig.
Log Rank (Mantel-Cox)	77.177	2	0.000
Breslow (Generalized Wilcoxon)	125.163	2	0.000
Tarone-Ware	113.268	2	0.000

The test of equality over the type of case versus the type of court was significant and hence implies that the average time to judgment vary simultaneously with a change in both the type of case and court.

3.4. **Analysis on Whether the Survival Time to Justice Delivery Vary between the Types of courts.** In this section, quartiles estimates on the survival times, survival function on court type against the various cases and some specific test statistics were used to determine whether the type of court affect the time a case takes to close.

TABLE 7. Summary Statistics of Time from the start of a case to finish (total duration) for the various types of courts.

Quartile Estimates									
Percent	District court			Circuit court			High court		
	P. Est.	95% C I		P. Est.	95% C I		P. Est.	95% C I	
		lower	upper		lower	upper		lower	upper
75	300	210	330	78	56	98	210	198	255
50	160	157	219	84	45	.	103	78	160
25	75	45	78	20	.	55	71	60	76
Mean		S. D		Mean	S. D		Mean	S. D	
200		12.41		98	8.83		187	8.20	

Table 7 gives the summary statistics for the time variable duration, for District, Circuit and High courts respectively. The 25th percentiles for the District, Circuit and High courts were 75, 20 and 71 days respectively. The 75th percentiles for the District, Circuit and High courts were also 300, 78 and 210 days respectively. The 50th percentiles for the District and circuit courts were 160 and 84 days respectively whilst that for the High court was 103 days.

Fig. 6 below shows the survival distributions for the different types of courts. The horizontal axis shows the time to event and the vertical axis shows the probability of survival. Any point on the survival curve shows that a case in a given type of court will remain in the court past that time. Cases in the Circuit court had a steep survival curve which indicates short survival

times than those in the High and District courts with gradual survival curves which represent
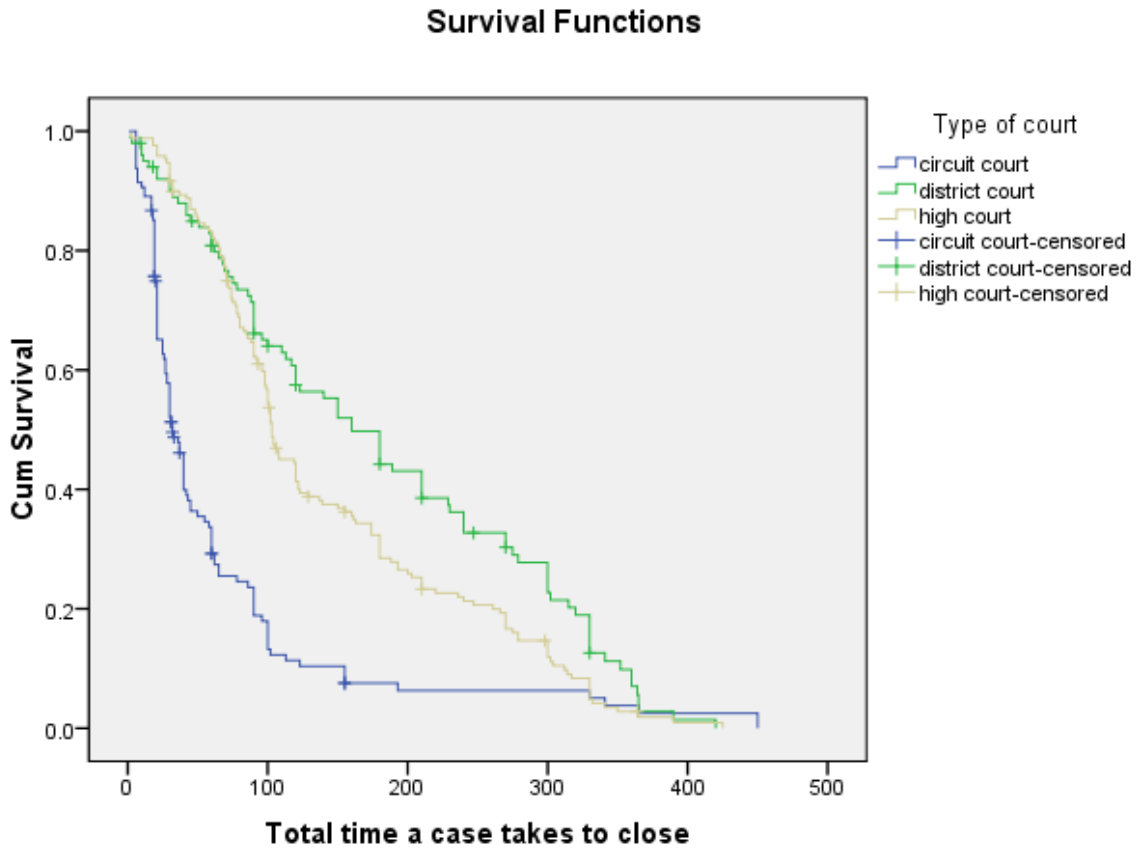high survival rate.

FIGURE 6. Plot of the survivor function for average time to justice delivery for
the type of court.

TABLE 8. Test of Equality of survival distributions for the different levels over
type of courts

Overall Comparisons

	Chi-Square	Df	Sig.
Log Rank (Mantel-Cox)	74.683	2	0.000
Breslow (Generalized Wilcoxon)	123.878	2	0.000
Tarone-Ware	113.446	2	0.000

Table 8 gives the test of equality over the types of courts. Here the log-rank, Breslow and Tarone-Ware test statistics were used to test for the equality over the different types of courts. The results indicate the test is significant for the entire three test statistics used, since their p-values are less than 0.05 (the significance level). Thus, we conclude that, the average time to judgment vary from court to court in the Northern Region of Ghana.

3.5. Modeling the Average Time to Justice Delivery and the Significance of Some Variables to Survival Rate of Cases.

3.5.1. *The Cox Regression Model (The SPSS Procedure).* The semi-parametric Cox regression model yielded the results displayed in Table 9 below. Out of the seven variables (age, sex, religion, occupation, number of subsequent hearings, type of court and type of case) tested, sex of the accused, number of subsequent hearings (subh), type of court, and type of case were the only significant variables. Thus, these were the variables that significantly accounted for the length of time a case stays in court.

The $exp(\beta)$ can be interpreted as the predicted change in the hazard for a unit increase in the predictor. For binary covariates, the hazard ratio is the estimate of the ratio of the hazard rate in one group to the hazard rate in the other group. The value of $exp(\beta)$ for case type means that the hazard for a criminal case is 1.318 times that of a civil case.

TABLE 9. Analysis of Maximum Likelihood Estimate for Cox Regression

Variables in the Equation

	β	SE	Wald	df	Sig.	Exp (β)	95.0% CI for Exp(β)	
							Lower	Upper
Sex	-0.278	0.132	4.471	1	0.034	0.757	0.585	0.980
SUBH	-0.031	0.006	24.76	1	0.000	0.970	0.958	0.982
Court_type	-0.391	0.072	29.365	1	0.000	0.676	0.587	0.779
Case_type	0.276	0.111	6.228	1	0.013	1.318	1.061	1.638

Hence from Table 9 the Cox regression model for the study is;

$$\log \lambda (t) = -0.278x_1 - 0.31x_2 - 0.391x_3 + 0.276x_4$$

Where $\lambda(t)$ is the hazard;

x_1 is the sex of the accused

x_2 is the number of subsequent hearings

x_3 is the type of court handling the case

x_4 is the type/nature of the case

$$\lambda(t) = e^{-0.278x_1 - 0.31x_2 - 0.391x_3 + 0.276x_4}$$

$$s(t) = \exp\left\{-\int_0^t \lambda(t)dt\right\}$$

$$s(t) = \exp\left\{-\int_0^t e^{-0.278x_1 - 0.31x_2 - 0.391x_3 + 0.276x_4}dt\right\}$$

3.5.2. *The Parametric Regression Model (The LIFEREG Procedure in SAS).* As in the case of the semi-parametric model, seven variables were further tested to determine which of them contribute significantly for the average time to justice delivery. The variables were: age, sex, religion, occupation, and number of subsequent hearings, type of court and type of case type. Out of the seven variables sex, number of subsequent hearing, type of court, and type/nature of case also accounted significantly for the length of time a case stays in court as shown in Table 10.This further reaffirms the results of the Cox Regression model.

TABLE 10. Analysis of Parameter Estimates for the Parametric Regression Model

Parameter	DF	Est.	S. Error	95% C. Limits		χ^2	$Pr > \chi^2$
Intercept	1	6.725	0.8726	5.0147	8.4353	59.37	$< .0001$
OCCUPATION	1	-0.2836	0.2003	-0.6761	0.109	2	0.1568
SEX	1	0.2113	0.3680.	-0.5099	0.9325.	0.3333	0.0002
SUBH	1	0.0262	0.0173	-0.0077	0.0601	2.2	0.0001
COURT TYPE	1	-1.409	0.3574	-2.1095	-0.7085	15.24	0.0001
CASE TYPE	1	-0.3821	0.299	-0.9682	0.2041	1.63	$< .0001$
SCLE	1	1.4972	0.182	1.1798	1.9		
Shape	1	0.5893	0.1618	0.2723	0.9064		

From Table 10 above the following parametric regression model was obtained;

$$\log Y = 6.7250 + 0.2113x_1 + 0.0262x_2 - 1.4090x_3 - 0.3821x_4$$

Where, y is the average time to justice delivery;

x_1 is the sex of the accused

x_2 is the number of subsequent hearing

x_3 is the type of court

x_4 is the type/nature of case

The parametric regression model for the average time to justice delivery follows a gamma distribution. The final model was therefore fitted using; sex, number of subsequent hearings, type of court and type/nature of case as the independent variables. Below are the parameter estimates of the reduced model.

$$Y = e^{(6.7250 + 0.2113x_1 + 0.0262x_2 - 1.4090x_3 - 0.3821x_4)}$$

TABLE 11. Testing Global Null Hypothesis: BETA=0

Test	Chi-square	DF	Pr > Chi square
Likelihood Ratio	189.212	1	<.0001
Score	165.857	1	<.0001
Wald	155.734	1	<.0001

Table 11 above consist of tests on independence of the average time to justice delivery from the covariates with the null hypothesis $H_0 : \beta_i = 0, i = 1, 2, 3, 4$. The test is significant, which implies that the average time to justice delivery depends on at least one of the covariates.

From the model it can be deduced that controlling for other covariates; the average time to justice delivery for cases in the circuit court was 260% and 180% less than those in the district and high courts respectively. whilst that for criminal cases was 15% greater than that for civil

cases. However, every additional hearing was associated with a 20% increase in the average time to justice delivery.

TABLE 12. Fit statistics for Parametric Regression Models

DISTRIBUTION	FIT STATISTICS	
	AIC	AICC
Gamma	**293.926**	**295.022**
Weibull	296.939	298.036
Exponential	297.326	298.274
Lognormal	295.89	297.146
Normal	648.564	649.661
Loglogistic	295.025	296.122

From Table 12, the best parametric model for the survival time is gamma because it has the least value of AIC and AICC compared to the other parametric models.

4. CONCLUSION

This study sought to determine the average time it takes for judgment to be passed on a case after it has been reported or after a complaint has been made (average time to justice delivery) for the entire data, and also for the different types of courts, and types of cases. It also sought to determine whether the nature of a case or type of court affect the time of judgment and finally to come out with a model to determine the average time to justice delivery in the Northern Region of Ghana.

Results showed that few (9.5%) of the cases were either pending or withdrawn and hence censored the rest (90.5%) were closed. However, most (43.8%) and (31.9%) of the closed cases were from the High and Circuit courts respectively with the District court recording the least of 24.4%. Although the District court recorded the least number of closed cases, it however had the highest survival time of (182 days).

The study also revealed that the overall average time to justice delivery is 130 days. This time varied across the different courts with the District court recording the highest of 198 days, High

court 155 days and Circuit court recording the lowest of 55 days for all criminal cases. For all civil cases the District court still recorded highest survival time of 157 days, High court 134 days and Circuit court the lowest of 79 days. In general, the overall average time to justice delivery for criminal cases was 138 days and that of civil cases was 120 days. Thus, it takes longer to deliver judgement on criminal cases compared to civil cases in all the levels of judiciary. Moreover, for the District court, factors that accounted for the higher survival time was attributed to the poorly equipped nature of the court, counsels and judges indisposed as at the time of collection of the data, inadequate evidence to support cases and judicial breaks.

ACKNOWLEDGMENT

SOURCE OF FUNDING

CONFLICT OF INTERESTS

The author declares that there is no conflict of interests.

REFERENCES

[1] L. Anzagra, A.O. Adebanji, P.T. Birteeb, Average time to justice delivery; a case study in the upper west and east regional district and circuit courts in Ghana. Developing Country Studies, 3(5) (2013), 15-21.

[2] N. Balakrishnan, Progressive censoring methodology: an appraisal. Test, 16(2) (2007), 211.

[3] V.A. Kumar, Judicial delays in India: causes & remedies. J. Law Policy Glob. 4(1) (2012), 16–22.

[4] S.B. Sinha, Judicial Reform in Justice-Delivery System. Pract. Lawyer, 4 (2004), 35.

[5] Y. Yuan, Prediction performance of survival models. Thesis, University of Waterloo, 2008.

[6] C.R. Dennison, Sentence length and recidivism: are longer incarcerations the solution to high rates of reoffending? Thesis, University of Toledo, 2013.

[7] L. Anzagra, Survival analysis of average time to justice delivery in upper east and upper west regions of Ghana. Doctoral Dessertation, University for Development Studies, 2010.

[8] G.S. Service, Ghana statistical 2010 population and housing census: summary report of final results. Ghana Statistical Service, (2012).

[9] P.D. Allison, Event history and survival analysis. Routledge, New York, 2018.

[10] P.D. Allison, Survival analysis using SAS: a practical guide. SAS Institute, Cary, 2010.

[11] T. Smith, B. Smith, Survival analysis and the application of Cox's proportional hazards modeling using SAS. Proceedings of the Twenty Sixth Annual SAS Users Group International Conference, 22–25, 2001.

[12] W.M. Onsongo, Nonparametric Estimation of Finite Population Total. Thesis, JKUAT-PAUSTI, 2018.

[13] W.M. Onsongo, R.O. Otieno, G.O. Orwa, Bias reduction technique for estimating finite population distribution function under simple random sampling without replacement, Int. J. Stat. Appl. 8(5) (2018), 259-266.

[14] W.M. Onsongo, R.O. Otieno, G.O. Orwa, Nonparametric estimation of distribution function for stratified populations. Int. J. Probab. Stat. 7(5) (2018), 125-129.

[15] B.M. Malenje, W.O. Mokeira, R. Odhiambo, et al. A multiplicative bias corrected nonparametric estimator for a finite population mean. Amer. J. Theor. Appl. Stat. 5(5) (2016), 317-325.

.