Chapter One

Introduction

1.0 Preface

In many elementary statistics researches, the subject matter is an arbitrarily and divided into two categories called descriptive and inductive statistics. Descriptive approach usually relates only to the calculation or presentation of visual or conceptual to summarize or characterize a set of data. While inductive approach used to test the statistical technique applied. This discussion of relative merits has so far been concerned mainly with application of nonparametric and semiparametric techniques.

Although Sudan is still one of the largest countries in Africa even after the separation of the Northern and Southern parts, it remains one of the most densely populated countries in the region and is home to 39 million people[1] (% of children under five years affected with epidemic diseases. With this rise in population and bearing in mind the political issues that have plagued the country with war and hostility for almost 55 years ago, healthcare has become an afterthought and basically lost during what the government might believe to be more pressing matters. History of the medical research and providing professional medical healthcare in Sudan traced back to 1903, when the welcome research laboratory was established in Khartoum as a part of the Gordon Memorial College. Recent health situation in Sudan, with an increasingly aging child out of population faced a double burden of disease with rising rates of communicable and non-communicable diseases. Therefore, this

[1] https://www.who.int/countries/sdn/en/ (2016)

study aims to apply nonparametric and semiparametric methods in 5 non-communicable diseases[2] that affected the study population. Sudanese children under 5 mortality rates was fell gradually from 157.9 deaths per 1,000 live births in 1968 to 63.2 deaths per 1,000 live births[3] in 2017.

The theoretical importance was applied through survival and hazard functions, Cox proportional hazard model and accelerated failure time model based on nonparametric methods that applied for the children dataset. Also, the identification of the hazard models using the healthy measures and indicators to identify the hazard. The practical importance reflected in presenting the contrast of Kaplan Meier vs. Weighted Kaplan Meier vs. Modified Weighted Kaplan Meier in estimating the heavy censored dataset as well proportional hazard models vs. accelerated model's comparative to estimate the survival and hazard functions.

1.1 Research Problem

Although survival analysis is one of the most applications used in biostatistical field, however the scientific studies has not covered all related issues. The research in this area devoted exclusively to nonparametric and semiparametric methods, and a few studies and books style seemed to predominantly have not justified the rigorous mathematical style. This research has attempted to bridge the gap between these extremes. However, this study is not intended to be exhaustive as the field is so extensive. The purpose is to provide a compendium of the better-known of nonparametric and semiparametric techniques such as MWKM and AFT in dealing with heavy censored data. Those derivations proofs

[2] 100 with Acute Renal Failure (22 died, 78 censored and median of survival time was17 days); 104 with Congenital Deformity Heart (24 died, 80 censored and median survival time was 18 days); 98 with Leukemia (19 died, 79 censored and median of survival time was 19 days); 483 with Septicemia (155 died and 328 censored and median of survival time was 13 days) and 313 with Sickle cell disease (15 died and 298 censored and median of survival time was 59 days)

[3] https://knoema.com/atlas/Sudan/Child-mortality-rate, accessed on Nov 2018

and mathematical details that relatively are easy grasped or which illustrated typical procedures in general nonparametric and parametric statistics are included. More advanced results are simply stated with references. Asymptotic distribution theory for order statistics derived since the methods are equally applicable to other statistical problems.

Hazard issues, which presented the risk factors that caused mortality or survival time especially for the heavy censored children, some of these risk factors can be modified by children to lower their risk and others cannot. These factors reduced the hazard ratio, which lead children to survival for long time, this issue has estimated through the hazard ratio, then each factor became known. The application of these models helped to identify the characteristics that lead to increase the probability of survival. The analysis depends on estimation of the survival and hazard functions. it estimates the median survival time for the current patients or in the future. The estimated results will assist in innovating a good therapeutic system or giving advice to the patient's parents at diagnosis. Therefore, applied such type of the research can help the authorities to identify the phenomenon and properties that lead to increase the likelihood of survival.

1.2 Research Objectives

The objectives of the research are to estimate the survival probability time of heavy censored children data, using nonparametric and semiparametric methods, in addition to create model that support in estimation the accurate probability survival rate through determining below points:

- Is the proportion of children will survive past certain time?
- At what rate, the survived children will they die or fail?
- Did the multiple causes of death or failure be considered?

- How do the circumstances or characteristics increase the probability of survival?
- How to ensure the number of missed censored children are recovered during the study?

In addition to obtain some effective measures that describe the relationship between Social Network Index (SNI) and time until death.

1.3 Research Importance

The theoretical importance presented specifically in applied nonparametric and semiparametric methods of 5 out 10 diseases[4] selected randomly for period from 2012-2016 and followed-up till 2017. this data collected from one of the biggest pediatric hospital in Sudan"*Jafar Ibn Auf Pediatric Hospital*", due to up-normal increasing of the children with chronic and acute diseases. Therefore, nonparametric and semiparametric methods have been preferred in survival analysis to reduce healthy challenges that being faced. Moreover, children mortality became an indicator of deprivation to measure the development levels of societies (Cramer 1987). Generally, it was significant to move forward reducing the proportion of children at risks to achieve part of the Sustainable Development Goals by 2030.

Cox proportional hazard model and accelerated failure model included the most influential factors in the survival of children patients, adding to innovate a simulation model to identify the factors that increased the hazard rate. Then to increase the knowledge of practicing the nonparametric and semiparametric

[4]Acute Renal Failure "http://dx.doi.org/10.1016/S0749-0704(05)70329-8"Congenital Deformity Heart"http://www.who.int/mediacentre/factsheets/fs370/en/"Leukemia"https://www.webmd.com/cancer/lymphoma/childhood-leukemia-symptoms-treatments"Septicemia "http://kidshealth.org/en/parents/sepsis.html"Sickle cell disease "http://kidshealth.org/en/parents/sickle-cell-anemia.html"

statistics tests in the various filed and urging decision-makers to improve the health environment.

1.4 Research Hypothesis

This research deal to verify several hypotheses as in below:

- Selected children data is not following a normal distribution
- MWKM has accurate probability survival time to the last censored data camper to WKM.
- AFT model is better than Propositional Hazard model (PH) in estimating large censoring data.
- Kruskal Wallis test has shown difference in the rank within 5 diseases and hazard ratio between affected children as well.

1.5 Research Materials and Methods

This study has covered the three research methodologies (descriptive, analytical and case study). The descriptive approach define the variables, in addition to the analytical method, using using statistical tools for non-scientific tests. Considering the above, the theoretical and practical sides of the research constructed as detailed below:

- Theoretical aspect, the study usesn metadata, which has escaped sources, periodicals, studies and similar messages to formulate this side.
- The applied aspect presented basic concepts as nonparametric “K-M, WKM and MWKM”; semiparametric methods “Cox PH model and Cox model with time-dependent covariates”; and parametric methods “Parametric PH model and the AFT model” for analyzing children survival dataset. Data collected from Jafar Ibn Auf Pediatric Hospital-department of statistic, the data was validated through interviewing authority at the federal levels "i.e. Central Statistical Bureau, Ministry of Health and pediatric patients, UNICEF

records, WHO records and Biostatistician". Analytical method inferential to study the nonparametric estimates of the survival and hazard functions, Cox proportional hazard model and accelerated failure model.

Majority of statistical packages used are SPSS, NCSS, XLstat and Stata because of better procedures for analyzing parametric, semiparametric and nonparametric for such data, conclusion and recommendation. Research case limited to 1098 Sudanese children<5 years that affected with 5 diseases from different areas.

1.6 Previous studies

The previous studies took place either in survival analysis or in pediatric, below are the samples:

1. **In (2016), Meiling Hao, Published Ph.D. thesis in "Nonparametric statistical inference for survival data", Department of Applied Mathematics, Hong Kong Polytechnic University.**

This study used the right censored and interval censored data among the most popular once. The methodology focused on the nonparametric statistical inference of right censored data and interval censored data. As the first part of this thesis, a penalized nonparametric maximum likelihood estimation of the log-hazard function is introduced in analyzing the right censored data. The smoothing spline is employed for a smooth estimation. The most appealing fact is that a functional Bahadur representation is established. Asymptotic properties of the resulting estimate of the unknown log-hazard function are proved. Furthermore, the local confidence interval and simultaneous confidence band of the unknown log-hazard function are provided, along with a local and global likelihood ratio tests. Also it investigate issues related to the asymptotic efficiency. As the second part of this thesis, the nonparametric inference

approach is extended to handle interval-censored data. also focused on the nonparametric inference of the cumulative hazard function, instead of the log-hazard function of the interval-censored data. The results and conclusion, the global asymptotic properties are justified under regularity conditions. The theoretical results are validated by extensive simulation studies. Applications are illustrated with some real datasets.

2. **In (2013) Steven N. MacEachern, Published paper in" Nonparametric Bayesian methods: a gentle introduction and overview**", **Department of Statistics, The Ohio State University, USA**, **Vol. 23, No. 6, 445–466.**

   This study presented the Nonparametric Bayesian methods, motivating the methods through the twin perspectives of consistency and false consistency. It applied through the various constructions of the Dirichlet process, outline number of the basic properties of this process and move on to the mixture of Dirichlet processes model, including a quick discussion of the computational methods used to fit the model. The author has reasonate on the philosophies of nonparametric Bayesian data analysis and then re-analyze a famous dataset. The re-analysis illustrates the concept of admissibility through a novel perturbation of the problem and data, showing the benefit of shrinkage estimation and the greater benefit of nonparametric Bayesian modeling. The study has concluded with a too-brief survey of sophisticated nonparametric Bayesian methods.

3. **In (2013) miss. Nasejje Justine, master's degree in "*Application of Survival Analysis Methods to Study Under-Five Child Mortality in Uganda*", University of Kwazulu-Natal, College of Agriculture, Engineering and Science School of Mathematics, Statistics and Computer Science.**

The study applied the infant and child mortality rates of Uganda to find out the factors strongly associated to these high rates to provide alternativ or maintain the existing interventions. The Uganda Demographic Health Survey (UDHS) funded by USAID, UNFPA, UNICEF, Irish Aid and the United Kingdom government provides a dataset which is reach out for 9,247 women interviewed and only 6,692 women are considered for this research because it excluded all birth in 2011, and 62 of the children. These methods are used to examine factors affecting under-five child mortality in Uganda using R and STATA. Results obtained by fitting the Cox-proportional hazard model, frailty models and drawing inference using both the frequentists and Bayesian approach showed that, demographic factors are strongly associated with high under-five children mortality rates. Heterogeneity or unobserved co-variates are found to be significant at household level, but insignificant at community level.

4. **In (2013), Radhey S. Singh & Dishna P. Totawattage, University of Waterloo and University of Guelph, Canada are published a paper in "*The Statistical Analysis of Interval-Censored Failure Time Data with Applications*", in Open Journal of Statistics, 155-166.**

This study aims to prove the analysis of survival data through interval censored data reflect uncertainty as to the exact times. The units failed within an interval used parametric and nonparametric methods Breast Cancer, Hemophilia, and AIDS data were used to illustrate the methods during this study. Theory and methodology of fitted models for the interval-censored data are described.

Fitting of parametric and nonparametric models to three real datasets are considered. Results derived from different methods are presented and compared.

5. **In (2013) Boryung Ju and Tao Jin, School of Library and Information Science, Louisiana State University, 267 Coates Hall, Baton Rouge, LA 70803, USA, published paper "*Incorporating nonparametric statistics into Delphi studies in library and information science*", IR information Research VOL . 18 NO. 3**

This study aims to explore how nonparametric statistical techniques could mitigate the drawback and be incorporated into Delphi studies in library and information science. The study investigated the barriers and challenges encountered by scientists using various information and communication technologies for their distributed collaboration activities. 24 participants are recruited into two domain groups (social and behavioral sciences vs. science and engineering). The results, after three rounds of data collection and analyze using nonparametric statistical measurements, 40 items are identified as the most important. Different rankings of the items are observed between the groups involved.

6. **In (2013), Arfan Raheen AFZAL and Sabrina ALAM, International Centre For Diarrheal Disease Research, Bangladesh (Icddr, B), published a scientific paper in "*Analysis and Comparison of under Five Child Mortality Between Rural and Urban Area in Bangladesh*", JAQM (Vol No 82 Summer 2013).**

The study is conducted using Bangladesh Demographic and Health Survey (BDHS)-2007 data, the fifth BDHS undertaken in Bangladesh. A two-stage sampling technique was conducted for this survey. Information collected about child mortality aged less than five years from the Women's questionnaire where

the mother was asked to provide information about her children i.e., birth order of the child, its living status. According to the BDHS-2007 data, the number of children aged five years or less were 6,241 out of which 4,104 were from rural and 2,137 were from urban area. From the total children, 366 were failed (5.9%of which 260 were from rural and 106 were from urban area) . As influential factors for child mortality considered the variables: Sex, mother's age, mother's education, birth order and economic status of the family of each considered child. This paper investigated the causes and differences of under-five mortality between rural and urban area in Bangladesh using Kaplan-Meier, Cox Proportional Hazard (Cox-PH) and Accelerated Failure Time (AFT) Regression model. The results show that for both areas, survival probability for children whose mothers have higher education is very high and in urban area the failure rate is very high for children of poor economic status. The Cox-PH analysis reveals that risk of death was lower for children whose mothers were mature and highly educated than younger and illitrate mother in rural area. In urban area, children from rich family and the 2^{nd} or 3^{rd} child have lower risk of death compared to the poor family 1^{st} child. The AFT analysis shows that for both areas, Weibull distribution better fits the data.

7. **In (2012), Nazera K. Dakhil, Yahya M. Al-Decemberali, Muna A. Mseer Al-A'bidy, College of Mathematics and Computer Sciences University of Kufa, published scientific paper" Analysis *of Breast Cancer Data using Kaplan-Meier Survival Analysis*", in Journal of Kufa for Mathematics and Computer (Vol.1, No.6, December 2012, pp.-14).**

This research focus on analying the estimation of the survivorship time of real data of breast cancer patients in Iraq. Applied Kaplan–Meier estimator for the consisted 254 women from year 2005 until 2009. Malignant tumors group consisted of 71 patients with ages between 20–80 years. Benign tumors group

contained 83 patients with ages between 17–55 years. Other tumors group comprised 100 patients with ages between 16–70 years, to provides better estimation to determine the median when the sample size is reasonably large. The method used simple random sample of the patients and analyzed both descriptive and inferential statistics. The results of Kaplan–Meier method analyzed by SPSS. The conclusion has examined the distribution of time effected for two or more different groups. The comparison tests show that there is a statistically significant difference in survival times between malignant and benign tumors group only.

8. **In (2011), Jean-Bosco Gahutu and his colleagues, Butare University Teaching Hospital, Faculty of Medicine, National University of Rwanda, Butare, Rwanda, published paper "Prevalence and risk factors of malaria among children in southern highland Rwanda", doi: [10.1186/1475-2875-10-134].**

Increased control has produced remarkable reductions of malaria in some parts of sub-Saharan Africa, including Rwanda. In the southern highlands, near the district capital of Butare (altitude, 1,768 m), a combined community-and facility-based survey on Plasmodium infection was conducted early in 2010. Methods, a total of 749 children age below five years examined including 545 randomly selected from 24 villages, 103 attending the health center in charge, and 101 at the referral district hospital. Clinical, parasitological, hematological, and socio-economic data were collected. The result is *Plasmodium falciparum infection* (mean multiplicity, 2.08) is identified by microscopy and PCR in 11.7% and 16.7%, respectively; 5.5% of the children had malaria. PCR-based *P. falciparum* prevalence ranged between 0 - 38.5% in the villages, and was 21.4%

in the health center, and 14.9% in the hospital. Independent predictors of infection included increasing age, low mid-upper arm circumference, absence of several household assets, reported recent intake of artemether-lumefantrine, and chloroquine in plasma, measured by ELISA. Self-reported bed net use (58%) reduced infection only in univariate analysis. In the communities, most infections were seemingly asymptomatic, but anemia was observed in 82% and 28% of children with and without parasitemia, respectively. The effect increasing with parasite density, and also significant for submicroscopic infections. Conclusions, *Plasmodium falciparum* infection in the highlands surrounding Butare, Rwanda, is seen in one out of six children under five years of age. Risk factors suggestive of low socio-economic status and insufficient effectiveness of self-reported bed net use refer to areas of improvable intervention.

9. **In (2011), Zeleke Worku, Health SA Gesondheid "A survival analysis of South African children under the age of five years"School of Business, Tshwane University of Technology, South Africa.**

The South African Demographic Health Survey dataset (SADHS) of 2003 contains massive individual-level information on South African children under the age of five years selected from a random sample of 7,756 households. The dataset contains data on socio-economic, demographic, health-related and sanitary variables gathered by using multistage cluster sampling. The objective of the study was to identify key predictors of mortality amongst children under the age of five years. Logistic regression analysis and Cox regression are used for data analysis. Under-five mortality was significantly influenced by three predictor variables. The hazard ratio of the variable 'breastfeeding' is 3.09 with P = 0.000 and 95% confidence interval (CI) of (1.899, 5.033). The hazard ratio of

the variable 'toilet' is 2.35 with P = 0.016 and 95% confidence interval of (1.172, 4.707). The hazard ratio of the variable 'marital status' is 1.74 with P = 0.035 and 95% confidence interval of (1.041, 2.912). Adjustment is factored in the mother's level of education and wealth index.

10. **In 2010, Joseph C. Gardiner, Division of Biostatistics, Department of Epidemiology, Michigan State University, East Lansing, MI 48824, Published paper "*Overview of Parametric, Nonparametric and Semiparametric approaches and New Developments*" SAS Global Forum, 252-2010.**

This paper aims to apply time to event data arise in several fields including biostatistics, demography, economics, engineering and sociology. The terms *duration analysis*, *event-history analysis*, *failure-time analysis*, *reliability analysis* and *transition analysis* refer essentially to the same group of techniques although the emphasis in certain modeling aspects could differ across disciplines. Analysis done by using SAS. Methods include Kaplan-Meier estimation, accelerated life-testing models, and the ubiquitous Cox model. Recent developments in SAS extend their reach to include analysis of multiple failure times, recurrent events, frailty models, Markov models and use of Bayesian methods.

11. **In (2009), Jiezhi Qi submitted master thesis "*Comparison of Proportional Hazards and Accelerated Failure Time Models*" to the College of Graduate Studies and Research, Department of Mathematics and Statistics University of Saskatchewan Saskatoon, Saskatchewan.**

In between March 1993 - April 1995, there was 9,095 subjects are screened 2,158 participants have no HIV-related signs and 491 participants have one and 81 participants have two HIV-related signs. This study only included 2,158 subjects without any baseline signs or symptoms in current analysis. the log-

rank test for comparing the equality of two or more survival distributions, and the Cox proportional hazards (PH) model for examining the covariate effects on the hazard function. The accelerated failure time (AFT) model was proposed but seldomly used. The basic concepts presented for nonparametric methods (the Kaplan-Meier method and the log-rank test), semiparametric methods (the Cox PH model and Cox model with time-dependent covariates) and parametric methods (Parametric PH model and the AFT model) for analyzing survival data. The result is AFT model can provide a more appropriate description of the data while PH model less appropriated in some situations.

12. In (2009) the researchers Qamruz Zaman and Karl P Pfeiffer, published a scientific paper in "*Survival Analysis in Medical Research*", Department of Medical Statistics, Informatics and Health Economics, Medical University Innsbruck.

This study aims to describe some of the frequently used concepts of survival analysis in medical research. Nonparametric techniques (Kaplan - Meier method and log-rank test) for multivariate analysis, if the proportional hazards assumption is satisfied, semiparametric "Cox proportional hazard model" is used to identify risk factors, while in case of non-proportional hazard model, time-dependent regression model is applied to data set. The conclusion was due to relax conditions, semi-parametric and nonparametric methods are preferred over the parametric method. The Kaplan-Meier method, the log-rank test and the Cox's proportional hazards model are commonly used and popular in survival data analysis.

13. **In (2008), Abder oulidi, Jean-Marie marion, Hervé Ganachaud, Institute de Mathématiques Appliqués – 44 Rue Rabelais – BP 808 – 49100 ANGERS CEDEX 01, Groupe MMA – DCTGP - 10 Boulevard Alexandre Oyon – 72030 LE MANS Cedex 9, Published "*Survival analysis methods in Insurance Applications in car insurance contracts*", https://studylib.net/doc/8687251**

This study interested in survival models and applications on actuarial problems. Particularly, Cox and Aalen model study, which allow covariate effects to vary with time (time-dependent covariates). They are interested in the relationship between lifespan of contracts and some predictive covariates. Also studied time-dependent covariates. Compare the lifespan of car insurance contracts estimated by survival models (nonparametric, parametric and semi-parametric models with fixed and time-dependent covariates). The result, the main goal is to estimate survival function of car's insurance contracts. If they have no prior information on survival function, then they have estimated function with non-parametric "Kaplan-Meier method", semi-parametric model, the Cox model was considered. This model yields interpreted the estimation of covariates effects - the result from the test indicate that the proportional hazards assumption is not satisfied. The conclusions are the work on lifespan of car's insurance contracts is an illustration of well-known methods of survival analysis applied to a non-life insurance portfolio. Morever, the insurance company can use these estimations of survival function with covariates to develop, the profitability of insurance contracts auto.

1.6.1 Current study vs. the previous studies

The previous studies use the Kaplan Meier, Weighted Kaplan Meier and proposed Weighted Kaplan Meier to estimate the probability of survival time with result of bias in estimation the survival time. for instance, in K-M was zero estimation of survival time for the last censored data, in WKM was nonzero zero

estimation of survival time for the last censored data in proposed WKM, while in current study, MWKM has given the accurate estimation of survival time (1) for the last censored data. Also, in addition it presented the Hazard Functions, Proportional Hazard Model, fitted and compared the rank, the covariate of parametric and nonparametric factors. the current study applies the Nonparametric and semiparametric methods such as accelerated failure time model vs. PH model in estimating the heavy censored data. The theoretic, methods and the results are presented.

1.7 Organization of the Dissertation

The study structure has used a combination of theoretical, analytical and statistical method in writing the five chapters. Chapter One provides the introduction, research problem, research objectives, research importance, research hypothesis, research methodology, research limitation, the previous studies and organization of the dissertation. Chapter Two defines the literature review of survival analysis, parametric, semiparametric and nonparametric methods. Chapter Three shows overview of Health of Sudanese children, Epidemic Diseases of Sudanese children under 5 Years, Sudan Federal Ministry of Health; Jafar Ibn Auf Pediatric Hospital in Sudan; Mortality of Sudanese children under five years with epidemic diseases (Septicaemia, Sickle cell disease, Leukemia, Acute Renal Failure and Congenital Deformity Heart). Chapter Four shows the research methodology, which answer the research questions and statistical modeling of parametric, semiparametric. in addition to how the MWKM and AFT have more significant result in solving the problem under the study. Chapter Five, slight the results and recommendations of the statistical methods used, decent work and economic growth addition to alleviate children under five years mortality in Sudan.

Chapter Two

Literature Review

2.0 Preface

The principle of non-maleficence in medicine is to prevent, reduce and eliminate all types of harm (Beauchamp, 2013). Practices based on inaccurate information obtained through inappropriate statistical analysis methods may harm human health as well as confidence in medicine (Committee on Science,2009). Physicians make medical decisions about their own patients based on information such as the patient's medical condition, values, prognosis of the disease, and the effectiveness of the treatment. These decisions are also affecting other patients, since they also include how medical resources are distributed. Survival analysis, which contributes to the process of determining the prognosis of the disease and the effectiveness of the treatment, is a common method of statistical analysis in medicine. Survival analysis involves advanced methods to determine survival probability after a starting point in a certain tracking period until an interesting event such as death, illness, and relapse has been occurred. Thus, to compare different groups in terms of survival or to examine effects of treatment methods and other factors on survival period (Hosmer, 2008). In applied fields, especially clinical studies, it cannot always be possible to observe every person within determined period for the study until interesting event has been occurred. Study design contain censoring data that used in such cases. Because of several limits such as time and cost, censoring is to ignore data, which are unknown for certain and cannot be observed for any reason. There are three types of censoring as right, left and interrupted censoring. Some methods have been developed for estimating survival function in case of existence

censored data. These methods were semi parametric such as life table method, nonparametric methods such as K-M product-limit method, and parametric methods such as Weibull and exponential distribution.

2.1 Survival Analysis

Survival analysis refers to the collection of statistical procedures used to study the time between entry into the observation and the occurrence of some event related to the study population, which is often called as time-to-event analysis. Time to occurrence of event carries a great significance in reliability, medical or biological studies. The time indicates any unit of time from the beginning of the follow-up of an individual until an event of interest occurs. The outcome variable of interest is the elapsed time between a well-defined starting and ending points. In medical research the outcome variable or event of interest may be the death of a patient, relief from pain, the recurrence of symptoms, disease incidence, relapse from remission, remission duration of certain disease in clinical trials, incubation time of certain diseases, such as *AIDS, Hepatitis B* and in industry, the failure time of certain manufactured products (Cox and Snell 1968), (Crowley and Hu,1977), (Kalbfleisch and Prentice, 1980), (Cox and Oakes, 1984), (Clayton, 1978).

An initial step in the analysis of survival data is to provide numerical or graphical summaries of the survival times of the population under study. These summaries will describe in detail the nature of the data under concern. The development of methods has been particularly motivated by the need to analyze medical and health sciences data. Survival data are summarized through the estimates of the survival function and hazard function. Several non-parametric methods, which do not require any specific assumptions about the underlying distribution of the survival time were discussed decades ago.

Many researchers presented reports about life table (Berkson and Gage, 1950), (Peto and his colleagues,1976) have published an outstanding review of statistical methods related to clinical trials. The developments in the field that have had the most thoughtful impact on clinical trials are methods for estimating the survival function (Kaplan-Meier, 1958), Which has explained later and known as product limit estimator. It has become an important estimator in the analysis of survival data. This estimator has been in the continued attention for its simplicity and easiness to understand.

This introduction gives the descriptive overview of the children data analytical approach called survival analysis. This approach includes the type of problem and the outcome variable considered the need of what a survival function and a hazard function represented such basic data layouts for a survival analysis of the heavy censoring case, the Kaplan-Meier estimated was not reliable and overestimating the survival probabilities (Susan, 2001) also the Kaplan-Meier survival curve failed to give reliable estimates at the endpoints. To have a reliable estimation in case of heavy censoring an improved method of Kaplan-Meier estimation namely Weighted Kaplan-Meier method (Jan and his colleagues, 2005) was applied and proved for reliable estimate by introducing the weights based on the non-censored rate. Then, followed by a modified form of this, called proposed Weighted Kaplan-Meier method (Shafiq et al., 2007) was introduced by assigning a new weight in the case of the last observation censored. A Weighted Empirical Survival Function (WESF) was used by (Huang, 2008) in which choices of weights were introduced for obtaining the survival function. Later, the well-known Nelson-Aalen estimate was also used for obtaining the survival function by using its interrelationship between the survival function and the cumulative hazard function. Finally, some conclusions

are drawn for those 5 diseases meningitis data through comparing the estimated survival time that obtained in the mentioned methods (Aalen et al., 2009). Survival analysis is based on the time until an event occurs. Time is in a day from the beginning of follow-up until an event occurs or till end of the study. Time is a positive real-valued variable has a continuous distribution. In the medical researches the three techniques parametric, semi-parametric or nonparametric are used to obtain the estimation of probability median of survival time.

2.1.1 Survival time

Survival time is a variable which measures the time from a starting point (e.g. the time at which a treatment is initiated) to a certain endpoint of interest (Collet, 2003). In most situations, survival data are collected over a finite period due to practical reasons. The observed time-to-event data are always non-negative and may contain either censored or truncated observations (Klein and Moesch, 1998). The survival function is most useful for comparing the survival progress of two or more groups. The hazard function gives a more useful description of the risk of failure at any time point.

2.1.2 Survival function

The survival function model is the probability of an individual surviving beyond a specified time x. We denote X as the random variable representing survival time, which was the time until event of interest. In other words, the probability of experiencing the event of interest beyond time x is modeled by the survival function. The statistical expression of the survival function is shown in equation (2.1).

$$S(x) = Pr(X > x). \qquad (2.1)$$

Since X is a continuous random variable, the survival function can be presented as it is in equation (2.2), where $S(x)$ is the integral of the probability density function (PDF), $f(x)$

$$S(x) = Pr(X > x) = \int_x^{\infty} f(t)\, dt. \quad (2.2)$$

Therefore, by taking the negative of the derivative of equation (2.1) with respect to x, we have $f(x) = \frac{-dS(x)}{dx}$. (2.3)

The quantity $f(x)dx$ might be considered an approximate of probability that the event will occur at time x. Since the derivative of the survival function with respect to x is negative, then the function $f(x)$ represented in equation (2.3) will be non-negative. The survival curve, $S(x)$ can be plotted to graphically represent the probability of children's survival at varying time points. All survival curves have the following properties:1) $S(x)$ is monotone; 2) $S(x)$ is non-increasing; 3) When time $x = 0$, $S(x) = 1$; and 4) $S(x) \rightarrow 0$ as $x \rightarrow \infty$.

Although survival curves can take a variety of shapes, depending on the underlying distribution of the data, they all follow the four basic properties that mentioned previously.

The basic functions of survival analysis are the same in all fields, but it is familiar with different names. Survival analysis deals with models, methods and is used for analyzing data of lifetimes. One of the common uses of survival analysis in clinical trial is the comparison of survival times of different treatments in some fatal diseases. The demographer can use the technique in studying the length of working hours of a group of people, or duration of marriage. In an open exam, the examiner can use survival analysis for measuring the number of hours of completing the study. In engineering, one of the uses of survival analysis is the waiting time of failure of an item. In economics, we may

study the survival of a new business. Survival analysis is different from other procedures due to following reasons:

- In survival analysis the responding variable is always time.
- Staggered entries are more common in medical research, by staggered entries which mean that all children in the study do not have the same entrance time. This does not affect the survival analysis as the analysis deals with the length of the observation time and not based on the same entrance.
- The assumption of normality is not hold in survival analysis as survival data are generally skewed. The commonly used distributions in survival analysis are exponential, Weibull, lognormal, gamma, log-logistic. Concept of censoring which may affect the hazard function.
- Survival analysis is a very vast field, the main aim and things which tried in this study is to consider technical terms as much as possible and to describe the important and commonly topics used, and this will not only helpful for the experience but also for the emerging researchers for pediatric practitioners and the statisticians with less knowledge of the study's subject. Some books covered the concept of survival analysis such as Modeled the Survival Data in Medical Research (Collet, 1994), Statistical Models Based on Counting Processes (Andersen, 1993), Analysis of Survival Data (Cox,1984), Survival Analysis (Klein, 1997), Analyzing Survival Data from clinical trials and Observational Studies (Marubini,1995), and Survival analysis with Long-term Survivors (Maller,1996). The method is also used for the comparison of two or more treatments. Similarly, multivariate analysis procedure of survival analysis is used to obtain the risk factors.

Survival time is described by three functions:

1) The cumulative Proportion Surviving: Let the survival time (random variable) be denoted by T, Survival function is defined as the probability that an individual survives longer than t.

S(*t*)= *P* (*an individual survives longer than t*) and *S*(*t*)= 1 - *P*(*an individual fails before t*). The range of *S*(*t*) is 0 and 1*i.e.*, $0 \leq S(t) \leq 1$. The graph of survival function is a step function and is called survival curve. At time zero *S*(*t*) reaches to its maximum value (1) and if the last observed time is event time *S*(*t*) achieves the minimum value (0).

2) Probability Density Function: The probability density function of failure time data is defined as

$$f(t) = {lim_{\Delta t \to 0} P(t < T < \Delta t)}/{\Delta t}$$

$$f(t) = {dFP(t)}/{dt}$$

$$f(t) = \frac{d}{dt}(1 - S(t))$$

$$f(t) = \frac{-d}{dt}S(t) = -S'(t) \qquad (2.4)$$

The probability density function is also known as the unconditional failure rate.

3) Hazard Function: The hazard function is a measure of the probability of failure during a very small interval assuming that the individual has survived at the beginning of the interval. It is defined as

$$h(t) = {\lim_{\Delta t \to 0} P(an\ individual\ who\ survive\ to\ time\ t\ fails\ in (t, t + \Delta t))}/{t\Delta}$$

This function also known as instantaneous failure rate, force of mortality, conditional rate, and age-specific failure rate. The hazard function is not a probability as it does not lie between 0 and 1. The function is commonly used

for identifying the models such as exponential, Weibull or gamma curve that fits one's data. Survival model is usually expressed in terms of hazard function. The cumulative hazard function is defined as

$$H(t) = \int_0^t h(t)dt \quad , \quad h(t) = \frac{d}{dt} H(t)$$

There is exist relations among S(t), h(t) and f(t), by definition

$$h(t) = \frac{f(t)}{S(t)} = -\frac{s'(t)}{S(t)} = -\frac{d}{dt} log\, S(t)$$

$$H(t) = -log\, S(t)$$

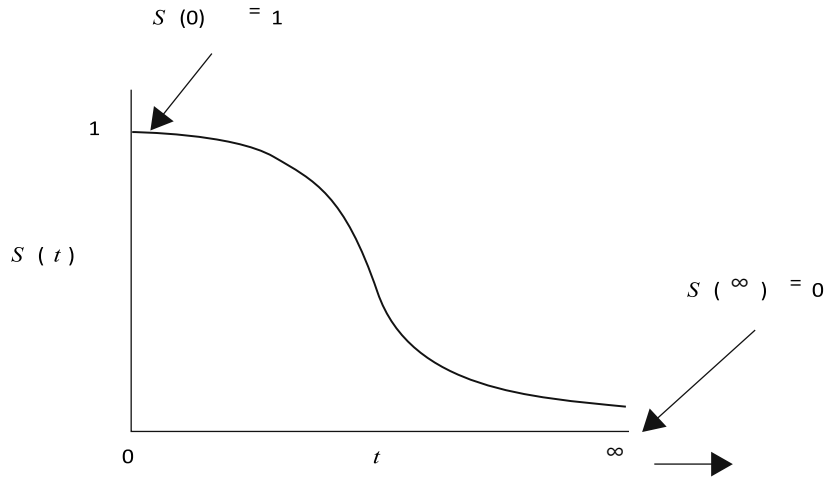
Equivalently,

$$S(t) = exp(-H(t)), \quad S(t) = exp\left(-\int_0^t h(t)dt\right)$$

By given any one of three functions $S(t)$, *h(t) and f(t)*, the others two could be derived the characteristics of survival distribution that used for estimating median survival time and survival probabilities. By comparing the survival times of different groups e.g., Survival times of control and placebo groups or to compare the survival times of males and females under 5 years, several methods have been developed. Similarly, in identified the potential risk/prognostic factors, methods of regression analysis the semiparametric and parametric approaches have been developed.

Theoretically, as *t* ranges from 0 up to infinity, the survivor function can be graphed as a smooth curve. As illustrated by the graph, where *t* identifies the *X*-axis, all survivor functions have the following characteristics they are no increasing, they head downward as *t* increases, at time $t = 0$, $S(t)=S(0)=1$; that at the start of the study since no one has gotten the event yet, the probability of surviving past time (0) is one; at time $t = \infty$, $S(t)=S(\infty)=0$; that is theoretically, if the study period increased without limit, this eventually means nobody would survive, so the survivor curve must eventually fall to zero. Note that, these are theoretical properties of survivor curves.

Fig (2.1): Characteristics of the Survival



Source*: Survival Analysis book second edition by David G. Kleinbaum Mitchel Klein, 2012.*

The basic goals of survival analysis in this study: Goal 1, it estimates and interpret survivor and/or hazard functions from survival dataset. Goal 2, it compares survivor and/or hazard functions for the dataset. Goal 3, it assesses the relationship of explanatory variables to survival time, usually requires using some form of mathematical modeling such as Cox proportional hazards approach, which became the subject of subsequent modules. The primary interest was the survival function, conventionally denoted by S, defined as:
$S(t) = Pr(T > t)$, $t > 0$, t is some time and T is the time of death, and "Pr" is the stands for probability. The survival function is the probability that the patient will survive till time t. Survival probability is usually assumed to approach zero as age increases. i.e., $S(t) \rightarrow 0$ as $t \rightarrow \infty$ (Johnson 1980/1999).

2.1.3 Lifetime's distribution function

The lifetime distribution function, conventionally denoted by *F(t)*, is defined as the complement of the survival function, i.e., $F(t) = Pr(T \leq t) = 1 - S(t)$ and the derivative of F(t) (i.e., the density function of the lifetime distribution) is

denoted by f(t), given by f(t) = - S/(t), where f(t) is called the event density, it is the rate of death or failure events per unit time (Johnson 1980/1999).

2.1.4 Hazard function and cumulative hazard function

The hazard function, conventionally denoted by λ, is defined as the event rate at time t conditional on survival until time t or later,

$$\lambda(t) = lim_{dt \to 0} \frac{Pr(t<T<t+dt/T>t)}{dt} \qquad (2.5)$$

the numerator of this expression is the conditional probability that the event will occur in the interval $(t, t + dt)$ given that it has not occurred before, and the denominator is the width of the interval.

2.1.5 Comparison of survival distributions

Kaplan-Meier survival function is used for estimating and drawing the single survival curve, but there are many situations in which we wanted to compare more than one curve. Several methods are used for comparing the survival distributions out of which the most commonly used rank-based tests are the log-rank (Mantel-Cox test ,1966) and (Gehan test,1965) also referred as Wilcoxon. The log-rank statistic like many others χ^2tests, consists of observed vs. expected events. This can explain by considering two to five groups. K medians is a variation of k means. The same process is performed, except that medians instead of means are computed to represent the group centers at each step.

- Life table method had been developed by Cutler and Ederer (1958). This method is a semi-parametric method, which evaluated the fact results of the study by grouping in the frame of time intervals determined by researcher (Cutler, 1958). Here, death probability is,

$q_j = \lambda_j / (n_j - 1/2 w_j)$

j: Period's time, λ_j: Number of died patients, n_j: Total number of patients in that time interval, w: Number of being withdrawn from the observation or being lost while alive, p_j has been calculated by subtracting survival probability, q_j in time interval of j, from 1, p_j=(1-q_j).

This probability is conditional, and it has been found among people who can live until that time's interval.

- Kaplan-Meier Product-Limit Estimator, is the limit of the life table estimator when intervals are taken so small, when the observation occurs within an interval. This estimator gives a maximum likelihood estimate. The log-rank test is appropriate when hazard functions for n groups are proportional over time, i.e., $h_1(t) = \emptyset h_2(t)$, so it is the most likely to detect a difference between groups when the risk of a failure was consistently greater for one group than another. Let $d(x)$ denote the number of deaths at time x. Generally, it is either 0 or 1, but we allow the possibility of tied survival time, which case $d(x)$ may be greater than 1. Let $n(x)$ denotes the number of individuals at risk just prior to time x. Then the Kaplan Meier estimate can be expressed as

$$\mathrm{KM} = \mathrm{S(t)} = \prod_{\mathrm{x \le t}} [1 - \mathrm{d(x)/n(x)}]$$

(2.6)

$$k \le n, t_{(j)} \le t \le t_{(j+1)}$$

d_j: The number of failures in t_j, n_j: The number of individuals at risk in t_j, k: The number of sequential observations, n: Total number of individuals.

In survival analysis, hazard function is the risk of ending life of a person who stays alive until a certain period (t) in next time interval $(\Delta + t)$. Hazard function (h(t)) is also named as failure rate, instantaneous death rate or force of mortality. Hazard function is obtained as equality

$$h(t) = \lim_{\Delta t \to \infty} \frac{P(t < T \leq t + \frac{\Delta t}{T} > t)}{\Delta t}$$

Note that in the notation above the product changes only at times where we observed deaths, or in general events (Kaplan 1958). If the last observation is censored, the Kaplan-Meier estimator fails to estimate the tails of the survival function. Further, this method overestimates the survival distribution in case of heavy censoring (Breslow, 1991). This Kaplan Meier was further modified by Mr. Bahrawar Jan, in his Ph.D. thesis known as Weighted Kaplan Meier estimates (Bahrawar, 2004) for heavy censoring.

- Weighted Kaplan-Meier, defined as

$$S^*(t) = \prod_{x \leq t} W_j[1 - d(x)/n(x)] \quad (2.7)$$

Where $W_j = (\frac{n_j - c_j}{n_j})$ is known as non-censoring rate.

The greatest defect in the Weighted Kaplan Meier gives zero weight to the last censored observation. So, a new weight function is proposed to remove the deficiency. The proposed estimator is Modified Weighted Kaplan Meier Estimator.

The Kaplan-Meier (product limit) method is a special case of the life table technique, in which the series of time intervals are formed in such a way that only one death occurs in each time interval and the death occurs at the beginning of the interval (Jan, 2004).

Suppose n is the total number of monitored participants in the study and $t_1, t_2, \ldots, t_n$ are the observed times. The survival time of some Children under study have censored. So, we assumed that the number of focused outcomes is r in which $r \leq n$ and $t_{(1)} \leq t_{(2)} \leq \cdots \leq t_{(r)}$ will be patients' ordered event times. Now, the number of patients who have survived before $t_{(j)}$ (including those who have died at this time) is $n_{(j)}$, and the number of those who have focused

outcome at $t_{(j)}$, is d_j, $(1 \leq j \leq r)$. Therefore, in the time interval less than t which is shown in $\hat{S}(t)$, the Kaplan-Meier estimator is as follows:

$$\hat{S}(t) = \prod_{j:t_{(j)}<t} \left\{\frac{n_j - d_j}{n_j}\right\} \quad (2.8)$$

If $t \leq t_{(1)}$ in which $t_{(1)}$ is the smallest survival time observed, so $\hat{S}(t) = 0$.

To calculate the Weighted Kaplan-Meier method in this study, a method provided by (Jan et al., 2005). They showed that when a considerable proportion of observations were censored, Kaplan-Meier estimation would be unreliable and inefficient. As in Kaplan-Meier we assumed C_J is number of censored patients at $t_{(j)}$ and W_J is the weights of censored observations. As the rate of un-censoring will be as follows:

$$W_J = \left\{\frac{n_j - c_j}{n_j}\right\}$$

If $t_{(j)}$ is one event-time, $W_J = 1$ and if $t_{(j)}$ is a censored time, $0<W_J<1$. Now, the Weighted Kaplan Meier estimation is defined as follows:

$$S^*(t) = \prod_{j:t_{(j)}<t} W_J \left\{\frac{n_j - d_j}{n_j}\right\}$$

In this formula, $S^*(t)$ solves the problem of overestimation (that existed in the Kaplan-Meier estimations) by proper weighing.

- Modified Weighted Kaplan Meier, The Modified Weighted Kaplan Meier Estimator is

$$S^{**}(t) = \prod_{x \leq t} W_j[1 - d(x)/n(x)] \quad (2.9)$$

Where the weight function is

$W_j = 1 - Sin(\frac{c_j * P_j}{n_j})$ is known as non-censoring rate.

The MWKM method is also supported by the analysis of real dataset (Kalbflesch & Prentice, 1980), which is classical survival data set.

2.1.6 Censoring data types

In the beginning of this chapter the survival data consist of censored or truncated observations. The discussion has focused on the right censored data that arises when the exact time points at which failures occur are unknown. However, I do have knowledge that each failure time occurs within certain period. Therefore, I have also introduced interval censored data, which are both common types of data encountered in real life scenarios. The censored happened when values of the variable status are not observed for some items in the children's sample. In medical studies, the actual time of death for some subjects may not be noted for many reasons such as children move away or the allocated time for the study elapses prior the events. The survival time of an individual is said to be censored when the event of interest could not be recorded for that individual. Censoring is broadly classified into two categories: Informative and uninformative. In this study, we considered informative censoring only. The important types of censoring are Type I censoring (or fixed time censoring), Type II censoring (or fixed number censoring), and random censoring and interval censoring. Type I and Type II are singly censored data whereas Type III is random censored data (Cohen, 1965). Type I, Type II and random censoring data are right censored. It is notable that when there are no censored observations, the set of survival times is complete. An important assumption for methods presented for the analysis of censored survival data was the children whose were censored at the same risk of subsequent failure as those who are still alive and uncensored. i.e., the children whom their survival time is censored at time C must be representative of all other children who have survived to that time. If this was the case, the censoring process called non-informative. Statistically, if the censoring process was independent of the survival time, *i.e.*

$$P(X \geq x, C \geq x) = P(X \geq x)\, P(C \geq x).$$

The objective was to examine the efficiency of several methods, which are commonly used to estimate survival functions in the presence of different types of censored data.

Right-censored data occurs when an individual has a failure time after their final observed time. For instance, we may want to know how long patients will survive after a kidney transplant. If we set up a 10-year follow-up study, it is possible that an individual move away before the end of the study. In this case we are not able to obtain information regarding the time to death. However, the time that patient passed away is known this is defined as the time point at the true survival time is right-censored. It is also possible that at the end of a study period patient are still alive. In this case, the time when the study ends can be considered a right-censored data point.

A typical right-censored data set includes a variable for an individual's time on study and an indicator of whether the associated time is an exactly known or a right-censored survival time. Usually, we use an indicator variable of '1' if the exact survival time is known and an indicator '0' for right-censored times. Consider a simple dataset that has 5 individuals enrolled in the 5-years follow-up study. The raw data are listed as follows: 3+, 5+, 2, 4+,1. In this data set, there are three numbers having a "+" in the superscript, which is commonly used as an indication that these are right-censored data points. When doing a typical analysis of this data using statistical software, we will set the indicator to be '1' if there is no "+" in the superscript and '0' if there is a "+" present. This data set can also be written as (t_i,δ_i), values (3,0), (5,0), (2,1), (4,0), (1,1). In this format t_i is the variable representing the time associated with the i^{th} individual and δ_i is an indicator of whether the survival time for individual i was exact or right censored is represented by a horizontal line for everyone. An arrow at the end of

an individual's line indicates a right-censored survival time. Therefore, the failure time for individuals 3 and 5 is exactly known, but the failure times associated with individuals 1, 2 and 4 are right-censored. Individuals 1 and 4 were lost to follow at a certain time before the end of this study. Individual 2 was still alive at 5 years (end of the study period). Therefore, this individual has a survival time which was right-censored at 5 years.

Interval-censored data is occurring when the event of interest is known only to occur within a given period. Both left-censored and right-censored data are special cases of interval-censored data, where the lower endpoint is '0' and the upper endpoint is '∞', respectively. An example mentioned above as patients received a kidney transplant to observe how long people have survived after a kidney transplant. Consider that as part of the study, individuals are requested to make a clinic visit once a year. An individual may die sometime after last visit and before the next time that they are supposed to come in for another visit. Other things also have occurred, which caused the individual to be lost to follow-up between two visit times. Another possibility was that an individual died in an event such as a car accident, which was unrelated to the event of interest. In this case the time of death is considered a right-censored time point as the individual did not die from kidney failure (Lindsey, 1998).

The typical context in biostatistics is a data gathering process that records an event time T measured from a specified time origin in a sample of patients. However, when follow up ends the event may not have occurred in some patients resulting in right censored event times. What we know is that T exceeds U, where U is the follow up time. The survival times of these patients are censored, and U is called the censoring time. Censoring will also occur if say a patient dies from causes unrelated to the endpoint under study or withdraws

from study for reasons not related to the endpoint, such patients are lost to follow. When there is a competing risk for the endpoint of death, it is important to ascertain whether death is due to the cause under study. Other forms of censoring are possible depending on the type of study e.g., if the true event time T is not observed but is known to be less than or equal to V, we have a case of left censoring. If all that is known about T is somewhere between two times U and V $(U < V)$, we say it is interval censored.

Generally, one records many covariates $\mathbf{Z}$ (age, gender, address, date of admission, stage, symptoms, disease type, treatment, disease history, h(cm), w(kg), Freq. of visits, exit date, status), whose influence on the distribution of T is of interest. Due to the longitudinal feature of the data gathering process some covariates are time-invariant, while others can be time-varying. The latter may arise from intermediate events that influence the distribution of T. Multi-state models are provided a means of analyzing data with multiple event times. Despite the intention in recording all covariates relevant to a specific analysis, there was heterogeneity encountered in patient samples which cannot be explained by the observed covariates alone. Unobserved heterogeneity is likely in observational studies. Frailty models and finite-mixture models can be very informative in this regard (Nasejje, 2013).

With censored data, it is not obvious how to estimate such standard quantities as the mean and variance. Thus, different methods need to be developed. The different approaches can be classified as parametric, semiparametric, distribution-free and fully nonparametric. The term "i" derives from the historical development of the field, (John Graunt's 1662) book "Natural and Political Observations upon the Bill of Mortality", which classified registered deaths by age, period, gender and cause of death, suggested for the first time that death is regarded as an event which deserves systematic study. Broadening the

term survival analysis to include data on any event observed over time, not just death or failure came with the use of such methods in clinical trials and the social sciences, where events such as disease progression or metastasis or first employment after formal education are also interest. Splendid approach and the seminal paper by Kaplan and Meier have marked a big breakthrough in survival analysis, especially from the nonparametric point of view. It allowed the use of descriptive statistics and fueled the development of all existing nonparametric approaches with censored data. And this study has unified presentation that given of the fully nonparametric approach (Michael, 2004).

Techniques of Survival analysis have substantial impact on the development of medical research. Almost every medical journal contained some material/articles which directly or indirectly used the methods of survival analysis. The Kaplan-Meier method, the log-rank test and the Cox's proportional hazards model are commonly used in survival data analysis. When the proportional hazards assumption is not satisfied, the time-dependent covariate is easily incorporated into the model by using available software. The development of computer software's provided facility of identifying the correct parametric distribution as well as the model. If the data follows a specific distribution, results obtain have smaller variance as compared to nonparametric methods (American Statistical Association). Except all these efforts there is still a scope for improvement and understanding of the relation between nonparametric, semiparametric and parametric basic concepts and biostatistics.

large censored data is a form of missing data problem that is common in survival analysis. In (Jan et al., 2005) and (Kim et al., 2006) have revealed that if there was high censorship (i.e. 27% of population study are censorship, it should counted as large censored data. It also happens with a lifetime less than some

threshold, may not be observed at all, this is called truncation. Note that truncation is different from left censoring, since for a left censored datum the exists subject is known, but for a truncated datum we may be completely unaware of the subject. Truncation is also common in a so-called delayed entry study subjects are not observed at all until they have reached a certain age e.g., children may not be observed until they have reached the age to enter school. Any decreased subjects in the pre-school age group would be unknown. Left-truncated data are common in actuarial work for life insurance and pensions. Generally, encounter the left-censored data can occur when a person's survival time becomes incomplete on the left side of the follow-up period for the person.

2.2 Nonparametric, Semiparametric and Parametric Approaches

In survival analysis, it was always a good idea to present numerical or graphical summaries of the survival times for the individuals. In general, survival data are conveniently summarized through estimates the survival function and hazard function. The estimation of the survival distribution provides' estimates of descriptive statistics such as mean of the survival time, these methods are parametric or semiparametric since assumptions of the distribution of survival time are required (Joseph et al., 2010).

Although the basic statistics researches often include a brief description of some of the better-known and simpler nonparametric and semiparametric methods, usually the treatment is necessarily perfunctory and perhaps even misleading. Discussion of only a few techniques in a highly condensed fashion may leave the impression that nonparametric and semiparametric statistics consists of a bundle of tricks, which are simply applied by following a list of instructions dreamed up by some statistician as a panacea for all sorts of vague and ill-

defined problems. One of the deterrents to meet this demand has been the lack of a suitable textbook in nonparametric techniques.

The main goals presented in this research are: Firstly, to bring the material covered to the beginner statisticians such as nonparametric and semiparametric materials concerning the heavy censored data, the calculation of exact power and simulated power, other goodness-of-fit tests and multiple comparisons using modern computer solutions. Many new references have made no attempt to make the references comprehensive on some current minor refinements of the procedures covered. Secondly, more fully integrated the applications with the theory given tabular guides for applications of test and confidence intervals, both exact and approximate placed more emphasis on reporting results using *P* values. The primary change in presentation was an integration of the discussion of numerical theory and applications. When the package solutions are not equivalent, which happens frequently because most of the packages use approximate sampling distributions and the reasons will be discussed in brief.

2.2.1 Nonparametric approach

Nonparametric tests sometimes called distribution-free tests, because they are based on fewer assumptions. Parametric tests involve specific probability distributions and the tests involve estimation of the key parameters of that distribution such as the mean or difference in means from the sample data. The cost of fewer assumptions was that nonparametric tests.

Sometimes it’s difficult to assess the continuous outcome follows a normal distribution and whether a parametric or nonparametric test is appropriate. There are several statistical tests that can be used to assess whether data are likely from a normal distribution. The most popular are the Kolmogorov-Smirnov test, the

Anderson-Darling test, and the Shapiro-Wilk test. Each test is essentially a goodness-of-fit test and compares observed data to quintiles of the normal distribution. The null hypothesis for each test is H_0: data follow a normal distribution versus H_1: data do not follow a normal distribution. If the test is statistically significant e.g., $P<0.05$, then data do not follow a normal distribution, and a nonparametric test is warranted. It should be noted these tests for normality can be subject to low power. Specifically, the tests may fail to reject H_0: data follow a normal distribution when in fact it doesn't follow a normal distribution. Low power is a major issue when the sample size is small - which unfortunately is often when we wish to employ these tests. The most practical approach to assess the normality involves investigating the distributional form of the outcome in the sample using a histogram and to augment that with data from other studies, if available that may indicate the likely distribution of the outcome in the population. There are situations where the outcome does not follow a normal distribution (Lisa, 2010). These include situations when the outcome is an ordinal variable or a rank, there are definite outliers, or the outcome has clear limits of detection. A large portion of the field of statistics and statistical methods is dedicated to data where the distribution is known. Samples of data where we already know or can easily identify the distribution are called parametric data. Often, parametric is used to refer to data that was drawn from a Gaussian distribution in common usage. Data in which the distribution is unknown or cannot be easily identified is called nonparametric.

Nonparametric test and advantages, the module has described some popular nonparametric tests for continuous outcomes (Conover,1980). Nonparametric tests have some distinct advantages. With outcomes such as those described

above, nonparametric tests may be the only way to analyze the outcomes data such as ordinal, ranked, subject to outliers or measured imprecisely are difficult to analyze with parametric methods without making major assumptions about their distributions, as well as decisions about coding some values which was not detected. The key concept of parametric tests is generally more powerful and can test a wider range of alternative hypotheses. It is worth repeating that if data are approximately normally distributed. However, there are situations in which assumptions for a parametric test are violated and a nonparametric test is more appropriate.

Assigning ranks through applying the nonparametric procedures that have been described are followed the same general procedure. The outcome variable is rank from lowest to highest and the analysis focuses on the ranks as opposed to the measured or raw values. For the below example, the lowest value is then assigning ranks of 1, the next lowest a rank of 2 and so on. The largest value is assigned a rank of n=6. The observed data and corresponding ranks are shown below:

Table (2.1): Observed data and corresponding rank

Ordered the observed data	0	2	3	5	7	9
Ranks	1	2	3	4	5	6

A complicating issue that arises when assigning ranks occurs when there are ties

Table (2.2): Mean for Two or more equal ranks

Ordered the observed data	0	2	3	7	7	7
Ranks	1	2	3	5	5	5

in the sample (i.e., the same values are measured in two or more participants), such as observed data: 7 7 9 3 0 2
The 4^{th} and 5^{th} ordered values are both equal to 7. The recommended procedure is to assign the mean rank of 4.5 to each, the same for three values of 7. In this

case, we assigned a rank of 5 (the mean of 4, 5 and 6) to the 4th, 5th and 6th values, as follows:

Using this approach of assigning the mean rank when there are ties ensures that the sum of the ranks is the same in each sample (i.e., 1+2+3+4+5+6=21, 1+2+3+4.5+4.5+6=21 and 1+2+3+5+5+5=21). Using this approach, the sum of the ranks will always equal n(n+1)/2. When conducting nonparametric tests, it is useful to check the sum of the ranks before proceeding with the analysis. To conduct nonparametric tests, we follow the five-steps approach outlined in the modules on hypothesis testing (Siegel and Castellan, 1988).

Firstly, set up the hypothesis and select the level of significance α. Analogous to parametric testing, the research hypothesis can be one- or two-tailed, depending on the research question of interest. Secondly, select the appropriate statistical test in nonparametric tests, the observed data is converted into ranks then are summarized into a test statistic. Thirdly, setup the decision rule, which is a statement that tells under what circumstances to reject the null hypothesis. Note that in some nonparametric tests we reject H_0 if the test statistic is large such data under study, while in others we reject H_1 if the test statistic is small. We make the distinction as we describe the different tests. Fourthly, compute the test statistic by summarizing the ranks into the test statistic identified in the second step. The result is made by comparing the statistical test to the decision rule. Lastly, the conclusion is either to reject the null hypothesis (because it is very unlikely to observe the sample data if the null hypothesis is true) or not to reject the null hypothesis (because the sample data are not very unlikely if the null hypothesis is true). When we are comparing two independent samples and the outcome is not normally distributed, the samples were small then a nonparametric test is appropriate.

A popular nonparametric test to compare outcomes between two independent groups is the Mann Whitney U test. The later, sometimes called the Mann Whitney Wilcoxon Test or the Wilcoxon Rank Sum Test, used to test whether two samples are likely to derive from the same population (i.e., that the two populations have the same shape). Some investigators interpret this test as comparing the medians between the two populations. Recall that the parametric test compares the means (H_0: $\mu_1=\mu_2$) between independent groups. In contrast, the null and two-sided research hypotheses for the *nonparametric test* are stated as follows:

H_0: The two populations are equal versus

H_1: The two populations are not equal.

This test is often performed as a two-sided test and thus, the research hypothesis indicates that the populations are not equal as opposed to specifying directionality. A one-sided research hypothesis is used if interest lies in detecting a positive or negative shift in one population as compared to the other. The procedure for the test involves pooling the observations from the two samples into one combined sample, keep tracking of which sample each observation comes from, then ranking lowest to highest from 1 to n_1+n_2, respectively. Hypothesis testing with nonparametric tests, the hypotheses are not about population parameters like $\mu=50$ or $\mu_1 = \mu_2$. Instead of the null hypothesis is more general, when comparing five independent groups in terms of a continuous outcome, the null hypothesis in a parametric test is H_0: $\mu_j = \mu_k$, $j, k = 1, 2,3,4,5$.

Kruskal-Wallis test, is a popular nonparametric test to compare outcomes among more than two independent groups. which used to compare medians among k groups (k>2). The null and research hypotheses for the Kruskal Wallis

nonparametric test are stated as follows: H_0: The k population medians are equal versus H_1: The k population medians are not all equal. The procedure for the test involves pooling the observations from the k samples into one combined sample, keeping track, of which sample each observation comes from, and then ranking lowest to highest from 1 to N, where N = n_1+n_2+ ...+ n_k.

In the censored children data, the outcome was continuous, but the sample sizes are small and not equal across comparison diseases group (n_1=78, n_2=80, n_3=79, n_4=328, n_5=298). Thus, a nonparametric test is appropriate. The hypotheses tested are given below, with used a 5% level of significance.

H_0: The five censored medians of children are equal versus H_1: The five censored medians of children are not all equal. To test, firstly ordered the data in the combination total sample of 863 subjects from smallest to largest. Also need to keep track of the group assignments in the total sample.

Again, the goal of the test was to determine whether the observed data support the difference in the five population medians. In the Kruskal Wallis test, the information in a test statistic summarized based on the ranks. Notable that, the critical values for the Kruskal Wallis test for comparing 3, 4 or 5 groups with small sample sizes. Here we need to determine whether the observed test statistic H supports the null or research hypothesis. Once again, this is done by establishing a critical value of H. The test statistic for the Kruskal Wallis test is denoted H and is defined as follows:

$$H = \left(\frac{12}{N(N+1)}\sum_{j=1}^{k}\frac{{R_j}^2}{n_j}\right) - 3(N+1) \qquad (2.10)$$

where k is the number of comparison groups, N is the total sample size, n_j is the sample size in the j^{th} group and R_j is the sum of the ranks in the j^{th} group. If the observed value of H is greater than or equal to the critical value, we reject H_0 in favor of H_1; if the observed value of H is less than the critical value we do not reject H_0.

2.2.2 Semi-parametric approach

Is a model that is not fully parameterized, the Cox proportional hazards model is such a model:

$$h(t) = h_0(t)\, exp(\beta_0 x_0 + \cdots + \beta_k x_k) \quad (2.11)$$

In the Cox model, $h_0(t)$ is left unparameterized and not even estimated.

Meanwhile, the relative effects of covariates are parameterized as $\exp(\beta_0 x_0 + \cdots + \beta_k x_k)$.

If the parametric distribution known, that means the data follows the maximum likelihood approach and the distribution makes sense. The real advantage of Cox Proportional Hazards regression that can still fit the survival models without knowing (or assuming) the distribution. This is an example using the normal distribution, but most survival times (and other types of data that Cox PH regression is used for) do not come close to following a normal distribution. Some may follow a log-normal, or a Weibull, or other parametric distribution and if we would make that assumption, the maximum likelihood parametric approach will be great. But in many real-world cases we do not know what the appropriate distribution or even a close enough approximation. With censoring and covariates, we cannot do a simple histogram and say that looks like a normal distribution. So, it is very useful to have a technique that works well without needing a specific distribution.

Why this study aimed to use the hazard instead of the distribution function? Because such children with Septicaemia are twice as likely to die at age 5 in contrast to children in other remain groups-such as Congenital Deformity Heart (CDH) group. This could be true, because children with CDH tend to live longer than children with Septicaemia, or it could be because children with CDH tend to live shorter lives, and most of them are died long before age 5 giving a very small probability of dying at age 5, while children with Septicaemia live to fifth age, that was a fair number of them to die at that age giving a much higher probability of death at that age. So, the same statement could be in children with Septicaemia is better or worse than being in children with CDH. What makes more sense is to say, of those children (in each group) that live to 5 years, what proportion will die before they turn 6. That was the hazard and is a function of the distribution function/survival function or etc., it's easier to deal with the hazard in semi-parametric model and can give information about the distribution. Another point that was worth adding was that the censored data inspecting distributional assumptions can be very difficult. Suppose that the only 21% of children have observed an event, it doesn't mean that the range of survival analysis tools ranges from the fully non-parametric method to fully parametric models, where we have specified distribution of the underlying hazard. Each has their advantages and disadvantages. This could be helpful, as we don't always know the underlying hazard function and in many cases is not necessary. Therefore, many epidemiology studies want to know "does exposure X decrease the time until event Y?" they care about the difference in patients who have X and who do not have X. In that case, the underlying hazard doesn't really matter and the risk of miss specifying was worse than the consequences of not knowing it. Sometimes when this also is not true, we are preferring work with fully parametric models because of the underlying hazard is off-interest.

The Cox regression models for the diagnosis of the diseases assist the medical doctors in many studies to investigate the causes or the other characteristics of the diseases. For example, if the heart patient has the disease of high blood pressure? Or family history of diabetic related to the development of diabetic disease? In this case, high blood pressure and family history are referred to as covariates or risk factors or explanatory variables. The identification of the most important risk factors is become the important task for handling the disease. Regression analysis is generally used for identifying the risk factors. But due to the presence of censoring in the survival data, ordinary regression models are not used. For this purpose, Cox's regression model/Cox proportional hazard model is widely and popular due to the easy concept and accessibility of software used (Cox, 1972), (Altman,1994), (Lin,1991), (Bryson,1981).

There are several reasons for the failure of assumption. the most common reason is the involvement of time-dependent covariates such as the status of a baby which might change during the study period i.e. baby to crawls and from crawls to walk, the cholesterol level of a patient changes during the study period, regular examination of patients in a clinic. The modified form of the Cox proportional hazard model was obtained by dividing the exponential part into time independent and time-dependent parts. When we have several prognostic variables, multivariate approaches must be used. One very popular model in survival data was the Cox proportional hazards model, which was proposed by (Cox,1972), given by

$$h(t|x) = h_0(\mathrm{t}) \exp(\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_\mathrm{p} x_\mathrm{p}) = h_0(\mathrm{t})\, exp(\beta' x),$$

where $h_0(\mathrm{t})$ is called the baseline hazard function, which was the hazard function for an individual's variables included in the model are zero, $x = (x_1, x_2, \ldots, x_p)'$ is the values of the vector of explanatory variables for a

particular individual, and $\beta'=(\beta_1,\beta_2,\dots,\beta_p)$ was a vector of regression coefficients. The corresponding survival functions are related as

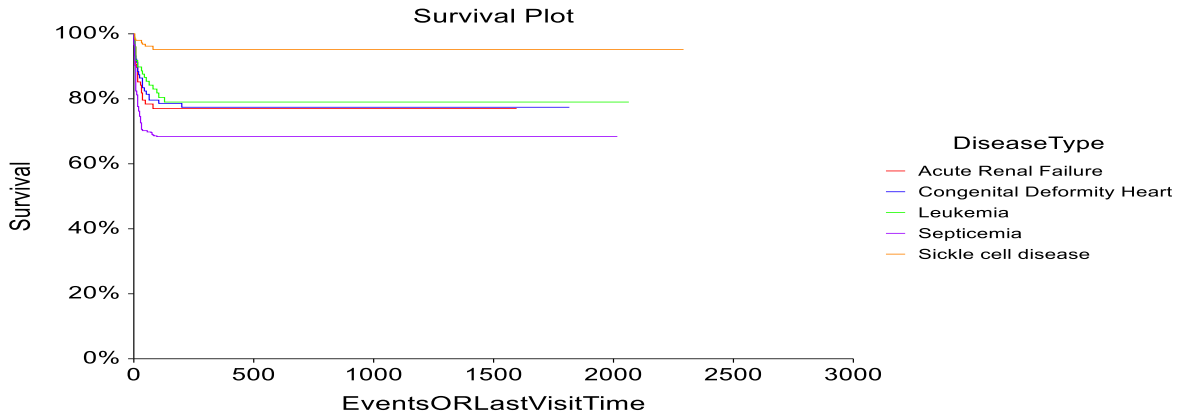
$$S(t|x)=S_0(\mathrm{t})^{\exp\sum_{i=1}^{p}\beta_i x_i}. \qquad (2.12)$$

The model is referred to a semi-parametric model. The Cox approach for this vagueness creates no problems for estimation. Even though, the baseline hazard is not specified, we can still get a good estimate for the regression coefficients, hazard ratio and adjusted hazard curves. The measure of effect is called hazard ratio e.g., the hazard ratio of two children with different covariates x and x^* was

$$\widehat{HR}=\frac{h_0\exp(\hat{\beta}'x)}{h_0\exp(\hat{\beta}'x^*)}=\exp(\sum\hat{\beta}'(x-x^*)). \qquad (2.13)$$

This hazard ratio was time-independent, this why was called the proportional hazards model, it assumption is the most important assumption for the log-rank and cox-regression model is the proportional hazards assumption. Consider the (Freireich *et al*.,1963) conducted leukemia data set, which was used completely or partially by (Kleinbaum, 1995), (Gehan,1965), (Rossa & Zielin, 2002) and (Borkowf, 2005). The data under study has consisted of the remission times in days of five groups i.e. treatment and placebo groups have1098 patients as in table (4.5). Placebo group was free of censoring, while for the treated group 235 events were occurred during the research period and 863 were censored. The survival plots of five groups is presented in figure (2.3) shows that cross in between the five curves, means that there was a variant vertical distance between the five curves. Since the five curves did cross at each point, the hazards for the five groups are proportional. Instead of plotting survival functions, the assumption could also check by plotting log {- log [S(t)]} against log t for each group.

Figure (2.2): Survival curve of disease since last hospital visit



Source: charted by researcher using NCSS

- Partial likelihood estimates for Cox-proportional hazards model, due to fit the Cox proportional hazards model, we need to estimate h_0(t) and β. One approach that attempted to maximize the likelihood function for the observed data was simultaneously with respect to h_0(t) and β. More popular approach was proposed by (Cox, 1975) in which a partial likelihood function that does not depend on h_0(t) is obtained for β. Partial likelihood is a technique developed to make inference about the regression parameters in the presence of nuisance parameters (h_0(t) in the Cox PH model). We constructed in the partial likelihood function based on the proportional hazards model.

Suppose t_1, t_2, …, t_n be the observed survival time for n children. Let the ordered death time of r children be $t_{(1)}<t_{(2)}< \ldots <t_{(n)}$ and $R(t_{(j)})$ be the risk set just before $t_{(j)}$ and r_j for its size. So that $R\,(t_{(j)})$ was group of a lived children and uncensored at a time just prior to $t_{(j)}$. The conditional probability that the *ith* individual dies at $t_{(j)}$ given that one individual from the risk set on $R\,(t_{(j)})$ dies at $t_{(j)}$ is

$P\,(individual\ i\ dies\ at\ t_{(j)} \mid one\ death\ from\ the\ risk\ set\ R(t_{(j)})$ at $t_{(j)})$

$$= \frac{P(individual\ i\ dies\ at\ t_{(j)})}{P(one\ death\ at\ t_{(j)})} =$$

$$\frac{P(individual\ i\ dies\ at\ t_{(j)})}{\sum_{k\in R(t_{(j)})} P(one\ death\ at\ t_{(j)})} \backsimeq \frac{P\{individual\ i\ dies\ at\ (t_{(j)}, t_{(j)}+\Delta t)\}/\Delta t}{\sum_{k\in R(t_{(j)})} P\{individual\ k\ dies\ at\ (t_{(j)}, t_{(j)}+\Delta t)\}/\Delta t}$$

$$= \frac{\lim_{\Delta t\downarrow 0} P\{individual\ i\ dies\ at\ (t_{(j)}, t_{(j)}+\Delta t)\}/\Delta t}{\lim_{\Delta t\downarrow 0} \sum_{k\in R(t_{(j)})} P\{individual\ k\ dies\ at\ (t_{(j)}, t_{(j)}+\Delta t)\}/\Delta t} = \frac{h_i\,(t_{(j)})}{\sum_{k\in R(t_{(j)})} h_k\,(t_{(j)})}$$

$$= \frac{h_0 t_{(j)})\ exp(\beta' x_i\, t_{(j)})}{\sum_{k\in R(t_{(j)})} h_k t_{(j)}) exp(\beta' x_k\, t_{(j)})}$$

$$= \frac{exp(\beta' x_i\, t_{(j)})}{\sum_{k\in R(t_{(j)})} exp(\beta' x_k\, t_{(j)})}\ .$$

Then the partial likelihood function for the Cox PH model is given by

$$L(\beta) = \prod_{j=1}^{r} \frac{exp(\beta' x_i\, t_{(j)})}{\sum_{k\in R(t_{(j)})} exp(\beta' x_k\, t_{(j)})} \qquad (2.14)$$

in which $x_i\,(t_{(j)})$ was the vector of covariate values for individual i who dies at $t_{(j)}$.The general method of partial likelihood was discussed by Cox. This likelihood function was only for the uncensored children. Let $t_1, t_2, \ldots, t_n$ be the observed survival time for n children and δ_i be the event indicator, which is zero if the i^{th} survival time is censored and unity otherwise. The likelihood function in equation (2.14) was expressed by

$$L(\beta) = \prod_{i=1}^{n} \left[\frac{exp(\beta' x_i\,(t_i))}{\sum_{k\in R(t_{(j)})} exp(\beta' x_k\,(t_i))} \right]^{\delta_i} \qquad (2.15)$$

Where $R(t_{(j)})$ was the risk set at time t_i. The partial likelihood was valid when there are no ties in the dataset. That means there is no two subjects have the same event time.

- Cox propositional hazard model and characteristics, the distribution for the baseline hazard function is not specified and that is why called a semi-parametric model. The Cox-proportional hazard model is a more general model in modeling the hazard and survival functions because it does not

place distributional assumptions on the baseline hazard. The Cox model was introduced by (Cox,1972). It has the form:

$h(t_j x)=h_0(t)\exp(X^T\beta)$ (2.16)

The measure of the effect of the given covariates on survival time is given by the hazard ratio denoted as HR. Consider a categorical variable with two levels say $X = 1$ and $X = 0$, then the hazard ratio for the two groups is defined as:

$HR=\frac{h(t|X=1)}{h(t|X=0)}=\exp(\beta)$. (2.17)

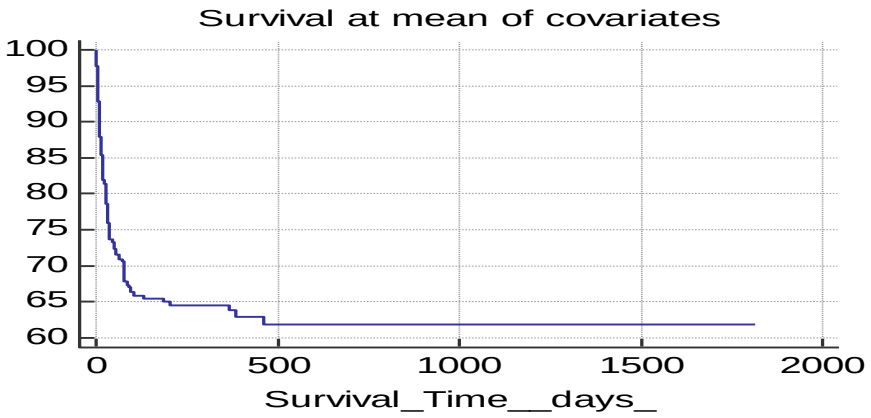
When *HR* = 1, it implies that the individuals in the two categories are at the same risk of getting the event, when HR>1, it implies that the individuals in the first category (X = 1) are at a high risk of getting the event and if HR <1, the individuals in the second category (X = 0) are at a low risk of getting the event. The Cox-proportional hazard model assumes a proportional hazard cannot be used in the situation where the assumption is violated.

- Proportional hazard assumption checking, the main assumption of the Cox proportional hazards model is proportional hazards. PH means, the hazard function of one individual is proportional to the hazard function of the other individual "the hazard ratio was constant over time".

1) Graphical method: Cox PH function in relationship between hazard function and survival function can obtained as $S(t, x)=S_0(t)^{\exp(\sum_{i=1}^{p}\beta_i x_i)}$, where X= $(x_1, x_2, \dots, x_p)'$is the values of the vector of explanatory variables for children's patient, by taking logarithm twice, easily we get $\ln[-\ln S(t,x)] = \sum_{i=1}^{p}\beta_i x_i+\ln[-\ln S_0(t)]$ for example, the difference in log-log curves corresponding to two different groups with variables $x_1 = (x_{11}, x_{12},\dots,x_{1p})$ and $x_2 = (x_{21}, x_{22},\dots, x_{2p})$ is given by $\ln[-\ln S(t, x_1)] - \ln[-\ln S(t, x_2)] = \sum_{i=1}^{p}\beta_i(x_{1i} - x_{2i})$,

which does not depend on *t*. By plotting the estimated log(-log(survival)) versus survival time for two or more groups, we will see the parallel curves of the hazards are proportional. This method does not work well for continuous predictors or categorical predictors that have many levels because the graph became cluttered. Furthermore, the curves are sparse when there are few time points and it may be difficult to tell how close to parallel was close enough. However, by looking at the K-M curves and log(-log(survival)) was not enough to be certain of proportionality since they are univariate analysis and do not show whether hazards will still be proportional if a model includes many other predictors. But they supported our argument for proportionality. Some other statistical methods for checking the proportionality are shown as below

Figure (2.3): Survival probability at mean of covariates



Source: charted by researcher using NCSS

2) Adding time-dependent covariates in the cox model: If the predictor of interest was X_j, then a time-dependent covariate creates X_j(t), X_j(t) = X_j × g (t), where g(t) is a function of time *t*, *log t* or Heaviside function of *t*. The model assessing PH assumption for X_j adjusted for other covariates is

$h(t, x(t)) = h_0(t)\, exp[\beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_j x_j + \cdots + \beta_p x_p + \delta x_j \times g(t)]$,

where $x(t) = \left(x_1, x_2, \ldots, x_p, x_j(t)\right)'$ was the values of the vector of explanatory variables for children<5 years, the null hypothesis to check proportionality is that δ = 0, the test statistic carried out using either a Wald test or a likelihood ratio test. In the Wald test, the test statistic was

$w = (\widehat{\delta}\,/se\,(\widehat{\delta}\,))^{2}$.

The likelihood ratio test calculates the likelihood under the null hypothesis L_0 and the likelihood under the alternative hypothesis L_α, then *LR* statistic shows as

$$LR = -2\, ln\,(L_0 = L_\alpha) = -2\,(l_0 - l_\alpha),$$

Where l_0, $l_\alpha$are log likelihood under two hypotheses respectively. Both statistics have a chi-square distribution with one degree of freedom under the null hypothesis. In the same way, the PH assumption for several predictors simultaneously can assessed.

3) Tests based on the Schoenfeld residuals: The other statistical test of the proportional hazards assumption is the Schoenfeld residual (Schoenfeld,1982). Schoenfeld residuals are defined for each subject observed to fail. If the PH assumption holds for a particularly covariate then the Schoenfeld residual for that covariate will not be related to survival time. So, this test is accomplished by finding the correlation between the Schoenfeld residuals for a particularly covariate and the ranking of individual survival times. The null hypothesis was that the correlation between the Schoenfeld residuals and the ranked survival time was zero. Rejection of null hypothesis concludes that PH assumption is violated.

- Cox proportional hazards model diagnostics, after a model was fitted, the adequacy of the fitted model needs to be assessed. The model checking procedures below are based on residuals. when censored observations are

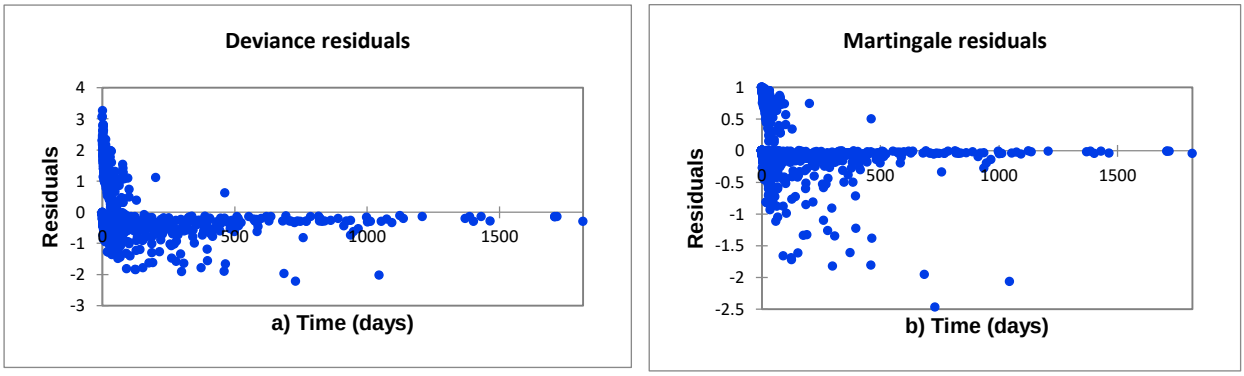
presented, the partial likelihood function is used in the Cox PH model; If the usual concept of residual is not applicable, there are three major residuals in the Cox model are described: The Cox-Snell residual, the deviance residual and the Schoenfeld residuals. Then we will talk about influence assessment.

1) Cox-Snell residuals and deviance residuals: The Cox-Snell residual for the ith individual with observed survival time $t_i$is defined as

r_{ci}= exp $(\hat{\beta}' \mathcal{X}_i)$ $\widehat{H}_0(t_i)$=$\widehat{H}_i(t_i)$= - log $\hat{S}_i(t_i)$,

where $\widehat{H}_0(t_i)$ is an estimate of the baseline cumulative hazard function at time t_i. The martingale residuals take values between negative infinity and unity. They have a skewed distribution with mean zero. The deviance residuals are a normalized transform of the martingale residuals (Therneau *et al.*, 1990). They also have a mean of zero but are approximately symmetrically distributed about zero when the fitted model is appropriate. Deviance residual can also use like residuals from linear regression. The plot of the deviance residuals against the covariates has obtained. Any unusual patterns may suggest features of the data that have not been adequately fitted for the model. In a fitted Cox PH model, the hazard of death for *i*th individual at any time depends on the value of exp($\beta' x_i$) which is called the risk score.

Figure (2.4): Deviance and Martingale residuals vs. the risk score of Cox PH



Source: charted by researcher using XLStat

2) Schoenfeld residuals: All the above three residuals are residuals for any individual. Covariate-wise residuals have described Schoenfeld residuals. The Schoenfeld residuals is called partial residuals because the Schoenfeld residuals for i^{th} individual on the j^{th} explanatory variable X_j is an estimate of the i^{th} component of the first derivative of the logarithm of the partial likelihood function with respect to β_j. From equation (2.14), this logarithm of the partial likelihood function is given by

$\frac{\partial \log L(\beta)}{\partial \beta_j} = \sum_{i=1}^{p} \delta_i \{x_{ij} - a_{ij}\}$,

where $x_{ij}$the value of the jth explanatory variable j = 1, 2,...,p for the i^{th} individual and

$a_{ij} = \frac{\sum_{l \in R(t_i)} x_j l \exp(\beta' x_l)}{\sum_{l \in R(t_i)} \exp(\beta' x_l)}$. The Schoenfeld residual for i^{th} individual on x_j is given by $r_{pji} = \delta_i \{x_{ji} - a_{ji}\}$. The Schoenfeld residuals sum to zero.

- Diagnostics for influential observations, Observations that have an undue effect on model-based inference are said to be influential. In the assessment of model adequacy, it is important to determine whether any influential observations are. The most direct measure of influence was$\hat{\beta}_j - \hat{\beta}_{j(i)}$, where $\hat{\beta}_j$is the j^{th} parameter $j = 1, 2, \ldots, p$, in a fitted Cox PH model and $\hat{\beta}_{j(i)}$ is obtained by fitting the model after omitting observation i. In this way, we must fit the n + 1 Cox models, one with the complete data and n with each eliminated observation. This procedure involved a significant amount of computation because the sample size was large. We would like to use an alternative approximate value that does not involved an iterative refitting of the model. To check the influence of observations on a parameter estimate, (*Cain and Lange*, 1984) showed that an approximation to $\hat{\beta}_j - \hat{\beta}_{j(i)}$ is the j^{th}

component of the vector $r'_{S_i}V(\hat{\beta})$, where $r'_{S_i}$is the $p \times 1$ vector of score residuals for the i^{th} observation, which are modifications of Schoenfeld residuals and are defined for all the observations, and $V(\hat{\beta})$ is the variance-covariance matrix of the vector of parameter estimates in the fitted Cox PH model. The j^{th} element of this vector is called delta-beta statistic for the j^{th} explanatory variable, i.e., $\Delta_i\hat{\beta}_j \approx \hat{\beta}_j - \hat{\beta}_{j(i)}$. Therefore, we can check whether there are influential observations for any particularly explanatory variable.

- Strategies of analyze non-proportional data, supposed that statistic tests or other diagnostic techniques gave strong evidence of non-proportionality for one or more covariates. To deal with this, we would have described two popular methods: stratified Cox model and Cox regression model with time-dependent variables, which are particularly simple and can be done by using available software. Another way to consider was to use a different model.

  1) Stratified Cox model: The stratifies on the predictors not satisfying the PH assumption. The data are stratified into subgroups and the model is applied for each stratum. The model is given by

     $h_{ij}(t) = h_{0g}(t)\exp(\beta' x_{ig})$,

     Where g represents the stratum. Note that the hazards are non-proportional because the baseline hazards may be different between strata. The coefficients β are assumed to be the same for each stratum g. A drawback of this approach is that we cannot identify the effect of this stratified predictor.

  2) Cox regression model with time-dependent variables: The second method to consider, is to modelized non-proportionality by time-dependent covariates. The violation of PH assumptions was equivalent to interactions between covariates and time (Zhao, 2008). The PH model

assumes that the effect of each covariate was the same at all points in time. If the effect of a variable varies with time, the PH assumption is violated for that variable. To model a time-dependent effect, one can create a time-dependent covariate $X(t)$, then $\beta X(t) = \beta X \times g(t)$.

$g(t)$ is a function of t such as $log\, t$ or Heaviside functions, etc. the choice of time-dependent covariates may be based on theoretical considerations and strong clinical evidence, The Cox regression with both time independent predictors X_i and time-dependent Covariates $X_j(t)$ can be written as $h(t|x(t))$=h_0(t) exp $[\sum_{i=1}^{p1} \beta_i X_i + \sum_{j=1}^{p2} \alpha_j x_j\,(t)]$. The hazard ratio at time t for the two individuals with different covariates x and x^* is given by $\widehat{HR}$(t)=exp $[\sum_{i=1}^{p1} \hat{B}_i(x^*{}_i - X_i + \sum_{j=1}^{p2} \widehat{\alpha_j}\ (\ x^*{}_j\,(t) - X_j(t))]$.$\widehat{\alpha_j}$ represents over all effect of $X_j(t)$ considering all times at which the variable has been measured in this study. This means, the hazard of event at time t was no longer proportional and the model was no longer a PH model. One of the earliest applications of the use of time-dependent covariates was in the report by (Crowley and Hu, 1972) on the Stanford Heart Transplant study. Time-dependent variables are usually classified to be internal or external.

2.2.3 Parametric approach

The literature concluded with a discussion of frailty models to know: the recognize form of a parametric survival model and contrast with a Cox model, the state of common distributions used for parametric survival models, and the contrast an AFT model with a PH model. Moreover, the interpret outputs from an exponential survival model, a Weibull survival model, a log-logistic survival model was to state or recognize the formulation of a parametric likelihood, state

or recognize right-censored, left-censored, interval-censored data, and state the form of a frailty model. The purpose of including a frailty component is to interpret the output obtained from a frailty model.

Parameters and Statistics are numerical descriptive measures corresponding to population. Since the population is not actually observed, the parameters are considered unknown constants. Statistical inferential methods can be used to make statements or inferences concerning the unknown parameters, based on the sample data. Parameters will be referred to Greek letters with the general case being θ.

For numeric variables, there are two commonly reported types of descriptive measures such as location and dispersion. Measures of location describe the level of the 'typical' measurement. Two measures widely studied are the mean (μ) and median. The mean represents the arithmetic average of all measurements in the population. The median represents the point where half the measurements fall above it and half the measurements fall below it. Two measures of the dispersion or spread of measurements in a population are the variance σ_2 and the range. The variance measures the average squared distance of the measurements from the mean. Related to the variance is the standard deviation (σ). The range is the difference between the largest and smallest measurements. We will primarily focus on the mean and variance. A measure has commonly reported in researches and papers was the coefficient of variation. This measure is the ratio of standard deviation to the mean, stated as a percentage $CV = ((\sigma/\mu)100\%)$. Generally small values of CV are considered best, since that means the variability in measurements is small relative to their mean. This is particularly important when data are being measured with scientific equipment, for instance when plasma drug concentrations are measured in assays. For categorical variables, the most common parameter is π, the proportion having the characteristic of

interest (when the variable has two levels). Other parameters that make use of population proportions include relative risk and odds ratios.

2.2.3.1 Parameters and statistics

Statistics are numerical descriptive measures corresponding to the samples. the general notation $\hat{\theta}$ was used to represent the statistics. Since samples are 'random subsets' of the population, statistics are random variables in the sense that different samples will yield different values of the statistic.

In the case of numeric measurements, suppose we have n measurements in our sample and we label them $y_1, y_2, \ldots, y_n$. Then we compute the sample mean, variance, standard deviation, and coefficient of variation as follow:

$\hat{\mu}$=y=$\sum n_i$=1

y_in=$y_1, y_2, \ldots, y_n$

nns^2=$\sum n_i$=1(y_i−y)2n−1=(y_1−y)2+ (y_2−y)2+⋯(y_n−y)2n−1s=$\sqrt{s^2}$

CV=(sy)100%

The parametric method is one of the survival models, which the distribution of the outcome (i.e., the time to event) is specified in terms of unknown parameters. Many such parametric models are acceleration failure time models, which provide an alternative measure to the hazard ratio called the "acceleration factor". The general form of the likelihood for a parametric model that allows for left, right, or interval censored data is also described.

Consider survival events that have occurred more than once over the follow-up time for a given subject. Such events are called "recurrent events". Analysis of such data carried out using a Cox PH model with the data layout augmented, so that each subject has a line of data for each recurrent event. A variation of this approach uses a stratified Cox PH model, which stratifies on the order in which recurrent events occur (five diseases). The use of "robust variance estimates" are

recommended to adjust the variances of estimated model coefficients for correlation among recurrent events on the same subject.

Survival data has considered for subject that experienced only one of several different types of events (competing risks) over follow-up. Modeling such data has carried out using a Cox model, a parametric survival model or a model which uses cumulative incidence (rather than survival). While the Cox model is the most widely use survival model in the health sciences, but it is not the only model available. A class of survival models have presented, called parametric models in which the distribution of the outcome (i.e. the time to event) is specified in terms of unknown parameters. Many parametric models are acceleration failure time models in which survival time is modeled as a function of predictor variables. The assumptions are examined the underlie accelerated failure time models and compare the acceleration factor as an alternative measure of association to the hazard ratio.

A parametric survival model is one in which the outcomes assumed to follow a known distribution. The commonly distributions that are used for survival time are: Weibull, exponential (a special case of the Weibull), log-logistic, lognormal, and the generalized gamma, all of which are supported by SAS and Stata software.

The Cox proportional hazards model by contrast is not a fully parametric model rather than is a semiparametric model even if the regression parameters (the betas) are known, the distribution of the outcome remains unknown. The baseline survival or hazard function is not specified in a Cox model. For parametric survival models, time is assumed to follow some distribution whose probability density function $f(t)$ can be expressed in terms of unknown parameters. Once a probability density function is specified for survival time, the corresponding survival and hazard functions could be determined. The

survival function S(t)= P(T> t) could be ascertained from the probability density function by integrating over the probability density function from time *t* to infinity. The hazard can be found by dividing the negative derivative of the survival function.

2.2.3.2 Parametric proportional hazards model

The parametric proportional hazards model was the parametric versions of the Cox proportional hazards model. It is given with the similar form to the Cox PH models. The hazard function at time t for the children<5 years with a set of p covariates $(x_1, x_1, \ldots, x_p)$ is given as follows:

$$h(t|x) = h_0(t)\, exp(B_1x_1 + B_2x_2 + \ldots + B_px_p) = h_0(t)\, exp\,(B'x)$$

Hazard ratios have the same interpretation and proportionality of hazard is still assumed. Many different parametric PH models may be derived by choosing different hazard functions. The commonly applied models used are Weibull, exponential or Gompertz models.

1) Weibull PH model: Suppose that survival times are assumed to have a Weibull distribution with scale parameter λ and shape parameter, so the survival and hazard function of a $W(\lambda, \gamma)$ distribution are given by

$$S(t) = exp(-\lambda t^{\gamma}), \qquad h(t) = \lambda\gamma(t)^{\gamma-1}$$

With λ, γ> 0. The hazard rate increased when γ>1 and decreased when γ< 1 as time goes on. When γ = 1, the hazard rate remains constant, which is the special exponential case.

Under the Weibull PH model, the hazard function of a particularly children<5 years with covariates $(x_1, x_2, \ldots, x_p)$ is given by

$$h(t|x) = \lambda\gamma(t)^{\gamma-1}exp(\beta_1x_1 + \beta_2x_2 + \ldots + \beta_px_p) = h_0(t) = \lambda\gamma(t)^{\gamma-1}exp(\beta'x). \quad (2.18)$$

Survival time for the patient observed has the Weibull distribution with scale parameter $\lambda \exp(\beta' x)$, and shape parameter γ. Therefore, the Weibull family with fixed γ possesses PH property. This shown the effects of the explanatory variables in the model alter the scale parameter of the distribution, while the shape parameter remained constant. From equation (2.18), the corresponding survival function is given by

$S(t|x) = \exp\{-\exp(\beta' x)\lambda t^{\gamma}\}$. (2.19)

After a transformation of the survival function for a Weibull distribution, we obtained

$$Log\{-log\, S(t)\} = log\lambda + \gamma\, log\, t.$$

$\{-log\, S(t)\}$ versus $log(t)$ should give approximately a straight line if the Weibull distribution assumption was reasonable. The intercept and slope of the line will be rough estimated of $\log\lambda$ and γ respectively. For example, if two lines for two groups in this plot were essentially parallel, this mean the proportional hazards model was valid. Furthermore, if the straight line has a slope nearly one, the simpler exponential distribution was reasonable. In the other way for exponential distribution, there was $\log S(t) = -\lambda t$. Thus, it could have considered the graph of $\log S(t)$ versus t. This should be a line that goes through the origin if exponential distribution was appropriate.

If the hazard function were reasonably constant over time, this would indicate that the exponential distribution might be appropriate. If the hazard function increased or decreased monotonically with increasing survival time, a Weibull distribution or Gompertz distribution might be considered (Weibull, 1959).

2) Exponential PH model: The exponential PH model is a special case of the Weibull model when γ = 1. The hazard function under this model is to assume that it was constant over time. The survival and hazard function are written as $S(t) = \exp(-\lambda t)$; $h(t) = \lambda$.Under the exponential PH model, the

hazard function of a particularly children<5 years is given by $h(t|x) = \lambda\, exp(\beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5) = \lambda\, exp\,(\beta' x)$.

The hazard ratio is the ratio of the hazard function that evaluated at two different values of the covariates: $h(t_j|x)/h(t_j|x_0)$. The hazard ratio is often called the relative hazard, especially when $h(t_j|x_0)$ is the baseline hazard function.

Hazard contributions are the increments of the estimated cumulative hazard function obtained through either a nonparametric or semiparametric analysis. For these analysis types, the estimated cumulative hazard is a step function that increases every time a failure occurs. The hazard contribution for that time is the magnitude of that increase, because the time between failures usually varies from failure to failure, hazard contributions do not directly estimate the hazard. However, one can use the hazard contributions to formulate an estimate of the hazard function based on the method of smoothing.

The piecewise exponential model (Zelen,1966) is an extension of the exponential PH model. For the piecewise exponential model, the period of follow-up is divided into k intervals $(t_j, t_{j+1}]$, $j=1, 2,...,k$; $t_1 = 0$. Assume that the baseline hazard is constant within each interval but can vary across intervals, so $h_0(t) = exp(\alpha_j) = \lambda_j$ for $t_j < t < t_{j+1}$, i.e., the baseline hazard function is approximated by a step function. The piecewise exponential model is given by

$\lambda_{ij} = \lambda_j exp(\beta' x_i)$, where λ_{ij} is the hazard corresponding to individual i in interval j and exp $(\beta' x_i)$ is the relative risk for an individual with covariate value x_i compare to the baseline at any given time. In the piecewise exponential approach, a log-linear model is used to model both effects of the covariates and the underlying hazard function. Estimates of the underlying

hazard function and the regression parameters can be obtained using maximum likelihood, which estimates of the baseline hazard function in interval i for given regression coefficients β is given by

$$\hat{\lambda}_j = \frac{d_j}{\sum_{i \in R_j} exp(\beta' x_i) t_{ij}}$$

where d_j is the number of events in interval j, R_j is the risk set entering interval j and t_{ij} is the observed survival time for individual i in interval j. This approach was first studied by (Holford,1976), also the subject of work by (Holford, 1980) and (Laird and Olivier, 1981). One of the greatest challenge related to used of the piecewise exponential model was to find an adequate grid of time-points needed in its construction, and one of the advantage of this method was the ability to incorporate time-dependent covariates.

3) Gompertz PH model: The survival and hazard function of the Gompertz distribution are given by $S(t) = exp(\frac{\lambda}{\theta}(1 - e^{\theta t}), h(t) = \lambda\, exp(\theta t)$ for $0 \leq t < \infty$ and $\lambda > 0$.

The parameter θ determines the shape of the hazard function. When θ = 0, the survival time has an exponential distribution, which also a special case of the Gompertz distribution. Like the Weibull hazard function, the Gompertz hazard increases or decreases monotonically. For the Gompertz distribution, $log(h(t))$ is linear with *t*. Under the Gompertz PH model, the hazard function of a children<5 years was given by

$$h(t|x) = \lambda \exp(\theta t)\, exp\left(\beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_p x_p\right)$$
$$= \lambda\, exp(\beta' x) exp(\theta t).$$

It is straightforward to see that the Gompertz distribution has the PH property. But the Gompertz PH model is rarely used in practice.

2.2.3.3 Accelerated failure time model

The AFT model has used to express the magnitude of effect in a more accessible way in terms of difference between treatments in survival time. The dataset was fitted by using exponential AFT model, Weibull AFT model, log-logistic AFT model, log-normal AFT model and gamma AFT model. For each model type, when fitted both univariate and multivariate AFT models, the independent variables (gender, age, date of first and last visits, children stage when arrived to hospital, symptoms, treatment, disease history, child height (cm), child weight (kg), freq. of hospital visit, status, survivor time) were significantly associated with the sample of diseases progression to the targeted children, while address and treatment variables didn't appear in the analysis, but by observation have significant effect as the acceleration factors in the corresponded confidence interval for every pair of group manually. Statistically no interactions in the multivariate AFT models. Results of different AFT models applied to the time of diseases progression are presented in Figure 6. No significant difference in estimations the models. The Q-Q plot could use to check the AFT assumption and the Q-Q plot approximates well to a straight line from the origin indicating that the AFT model may provide an appropriate model.

Although; Cox proportional hazards model is more frequently used in survival analysis, but still there exist some other models such as accelerated failure-time models. In this model, more attention was given to the survival time than to hazard function. in presence the of heavy censored data, we have replaced response variable by the resultant model called the accelerated failure time model (Wei,1879), (Jin,2008), the typical outlook of the model is log T_i.

$$\log T_i = \beta' Z_i + \varepsilon_i \qquad (2.20)$$

The role of the covariates in the above equation was to accelerate (or decelerate) the time to failure. The error terms $\varepsilon_i$are assumed to be independent and identical distributed with mean zero. Various choices of ε distribution lead to the regression version of different parametric survival models. A Weibull regression model was obtaining if ε has an extreme value distribution and a lognormal model is obtain if it has a standard normal distribution.

the accelerated failure time model performs was better than the proportional hazards model in applications where the effects of treatment are accelerated or delay the event of interest (Kay & Kinnersley, 2002). The equation (2.20) is referred to parametric model if the distribution of baseline hazards function is specified and not called a semi-parametric model. The main reason of the unpopularity of accelerated failure time model that has complicated estimation process, even if the data set consists small number of covariates. Similarly, the accelerated failure time is based on parametric model, which may be difficult sometime to fit, and this is one of the main reason of the popularity of proportional hazards model.

The distribution of the residuals (errors) is assumed to follow the exponential, extreme value, logistic, log-logistic, lognormal, lognormal10, normal, or Weibull distribution. This censored data types were often arising around accelerated life testing. The models that predicted failure rates at normal stress levels from test data on items that fail at high-stress levels are called acceleration models.

Basic assumption of acceleration models was failures happen faster at higher stress levels, this is the same to failure mechanism, but the timescale has changed (shortened).

If we stimulated that with a group of children<5 years with covariate $(x_1, x_2, \ldots, x_p)$, the model was writing mathematically as

$S(t|x) = S_0\big(t\big|\eta(x)\big)$, where $S_0(t)$ was the baseline survival function and η was an "acceleration factor" that was a ratio of survival times corresponding to any fixed value of S(t). The acceleration factor is given according to the formula

η(x) = exp ($\alpha_1 x_1$+ $\alpha_2 x_2$+...+ $\alpha_p x_p$).

Under an accelerated failure time model, the covariate effects are assumed to be constant and multiplicative on the time scale that was the covariate impacts on survival by a constant factor (acceleration factor), the hazard function for an individual with covariateX_1,X_2,...,$X_P$is given by

$h(t|x) = [(1|\eta(x)]h_0[(t|\eta(x)]$ (2.21)

The corresponding log-linear form of the AFT model with respect to time is given by $Log\ T_i = \mu + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \ldots + \alpha_p X_{pi} + \sigma\varepsilon_i$

Where μ is intercept, σ is scale parameter and ε_i is a random variable, assumed to have a distribution. This form of the model is adopted by most software package for the AFT model. For each distribution of ε_i there was a corresponding distribution for T. The members of the AFT model's class. The AFT models are discussed in detail in textbooks (Cox and Oakes, 1984), (Fleming and Harrington, 1991), (Schoenfeld, 1982). The AFT models are named for the distribution of T rather than the distribution of $\varepsilon_i$or $logT$.

Table (2.3): Summary of parametric AFT models

Distribution of ε	Distribution of T
Extreme value (1 parameters)	Exponential
Extreme value (2 parameters)	Weibull
Logistic	Log-logistic
Normal	Log-normal
Log-Gamma	Gamma

Source: Schoenfeld, 1982

The survival function of T_i can be expressed by the survival function of ε_i

$$S_i(t) = P(T_i \geq t) = P(logT_i \geq logt) = P(\mu + \alpha_1 X_{1i} + \alpha_2 X_{2i} + \ldots + \alpha_p X_{pi} + \sigma\varepsilon_i \geq logt) =$$

$$P(\varepsilon_i \geq \frac{logt-\mu-\alpha x}{\sigma}) = S_{\varepsilon_i}(\frac{logt-\mu-\alpha x}{\sigma}). \quad (2.22)$$

The distributions of ε_i and the corresponding distributions of $T_i$are summarized in Table (2.4). And the summary of the commonly used parametric models are described in Figure (2.21).

The effect size for the AFT model was the time ratio. The time ratio comparing two levels of covariate x_i (x_i = 1 vs. x_i = 0), after controlling all other covariates exp(α_i), which is interpreted as the estimated ratio of the expected survival time for the five groups. A time ratio above (1) for the covariate implies that this covariate prolongs the time to event, while a time ratio below (1) indicates that an earlier event is more likely. Therefore, the AFT models can be interpreted in terms of the speed of progression of a disease. The effect of the covariates in an accelerated failure time model was to change the scale and not the location of a baseline distribution of survival times.

2.2.3.4 Estimation of AFT models

AFT models are fitted using the maximum likelihood method. The likelihood of the n observed survival times $t_1, t_2, \ldots, t_n$ is given by

$$L(\alpha, \mu, \sigma) = \prod_{i=1}^{n} \{f_i(t_i)\}^{\delta_i} \{S_i(t_i)\}^{1-\delta_i},$$

where $f_i(t_i)$ and $S_i(t_i)$ are the density and survival function for the ith individual at t_i and δ_i is the event indicator for the ith observation. Using equation (2.22), the log-likelihood function is then given by

$log\ L(\alpha, \mu, \sigma) = \sum_{i=1}^{n}\{-\delta_i\ log(\ \sigma t_i + \delta_i\ log\ f_{\varepsilon_i}\ (z_i) + (1-\delta_i) log S_{\varepsilon_i}(z_i))\}$,

where z_i = (log $t_i - \mu - \alpha_i x_{1i} - \alpha_i x_{2i} - \cdots - \alpha_p x_{ni})/\sigma$,

The maximum likelihood estimates of the $p+2$ unknown parameters $\mu, \sigma, \alpha_1, \alpha_2, \ldots, \alpha_p$; are found by maximizing this function using the *Newton-Raphson procedure in SAS,* which was the same method used to maximize the partial likelihood in the Cox regression model (Boag, 1949).

Other approaches have been proposed for the estimation. Classical semi-parametric approaches to the AFT model that emphasize estimation of the regression parameters include the method of (Cox, 1972) and linear-rank-test-based estimators (Lim *et al.*, 2006). Despite theoretical advances, all these approaches are complicated numerically to implement, especially when the number of covariates is large.

1) Weibull AFT model: We have supposed that the survival time *T* has $W(\lambda, \gamma)$ distribution with scale parameter λ and shape parameter. From equation (2.21), under AFT model, the hazard function for the i^{th} individual is

$$h_i(t) = [1/\eta_i(x)]h_0[t/\eta_i(x)] = [1/\eta_i(x)]\ \lambda\gamma(\frac{t}{\eta_i(x)})^{\gamma^{-1}} = 1/[\eta_i(x)]^{\gamma}\ \lambda\gamma(t)^{\gamma^{-1}}$$

Where η_i = exp($\alpha_1 x_{1i}$+ $\alpha_2 x_{2i}$+ … + $\alpha_p x_{pi}$) for individual *i* with *p* explanatory variables. So, the survival time for the i^{th} children<5 years is $W(1/[\eta_i(x)]^{\gamma}\lambda, \gamma)$. The Weibull distribution has the AFT property. If T_i has a Weibull distribution, then ε_i has an extreme value distribution (Gumbel distribution). The survival function of Gumbel distribution is given by

$$S_{\varepsilon_i}(\varepsilon) = \exp(-\exp(\varepsilon)).$$

From equation (2.22), the AFT representation of the survival function of the Weibull model is given by

$S_i(t)$=exp[-exp ($\frac{\log t - \mu - \alpha_1 x_{1i} - \ldots - \alpha_p x_{pi}}{\sigma}$)]

= exp[-exp($\frac{-\mu-\alpha_1 x_{1i}-\ldots-\alpha_p x_{pi}}{\sigma}$)$t^{1/\sigma}$] (2.23)

From equation (2.19), the PH representation of the survival function of the Weibull model is given by

$S_i(t)$=exp {-exp ($\beta_1 x_{1i} - \ldots - \beta_p x_{pi}$) λt^{γ}} (2.24)

Comparing the above two formulas (2.23) and (2.24), easily can see that the parameter λ, γ, β_j in the PH model can be expressed by the parameters μ, σ, β_j in the AFT model

λ= exp((- μ/σ) , γ=1/σ , $\beta_j=\alpha_j/\sigma$ (2.25)

Using equation (2.1.5), the AFT representation of hazard function of the Weibull model is given by

$h_i(t)=\frac{1}{\sigma} t^{\frac{1}{\sigma}-1}$ exp ($\frac{-\mu-\alpha_1 x_{1i}-\ldots-\alpha_p x_{pi}}{\sigma}$) (2.26)

Suppose the pth percentile of the survival distribution for the i^{th} individual is t_i (p), which was the value such that

$S_i\ (t_i\ (p))=\frac{100-\mathrm{p}}{100}$. From equation (4.4), we can easily get

$t_i\ (p) = \exp[\sigma \log\{-\log(\frac{100-\mathrm{p}}{100})+\mu + \alpha' x_i]$. The median survival time is

$t_i\ (50) = \exp[\sigma \log(\log 2)+\mu + \alpha' x_i]$. (2.27)

To calculate the standard error of $\hat{\beta}_j$, for example we could use the approximate variance of a function of two parameter estimate θ_1, θ_2, which is given by

$(\frac{\partial g}{\partial \theta_1})^2$ v($\hat{\theta}_1$) +$(\frac{\partial g}{\partial \theta_2})^2$ v($\hat{\theta}_2$) +2$(\frac{\partial g}{\partial \theta_1}\frac{\partial g}{\partial \theta_2})$ cov (θ_1, θ_2).

The approximate variance of $\hat{\beta}_j$is expressed as V(β_j) = $(\frac{-1}{\hat{\sigma}})^2$ V($\hat{\alpha}_j$) + $(\frac{\hat{\alpha}_j}{\hat{\sigma}^2})^2$ V($\hat{\sigma}$)+ 2 $\left(\frac{-1}{\hat{\sigma}}\right)\left(\frac{\hat{\alpha}_j}{\hat{\sigma}^2}\right)$Cov ($\hat{\alpha}_j, \hat{\sigma}$).The square root of this, is standard error of $\hat{\beta}_j$. Then 95% confidence interval can be calculated.

2) Log-Logistic AFT model: Only limitation of the Weibull hazard function was a monotonic function of time. However, the hazard function could change the

direction in some situations. The Weibull model would have described in this section. The log-logistic survival and hazard function are given by

$$S(t) = \frac{1}{1+e^{\theta}\,t^{k}}\,, h(t) = \frac{e^{\theta}\,k\,t^{k-1}}{1+e^{\theta}\,t^{k}},$$

Where θ and k are unknown parameters and $k > 0$. When $k \leq 1$, the hazard rate decreases monotonically and when $k > 1$, it increases from zero to a maximum and then decreases to zero.

Supposed that the survival times have a log-logistic distribution with parameter θ and k, then from equation (2.21), under the AFT model, the hazard function for the i^{th} individual was

$$h_i(t) = (1/\eta_i)h_0(t/\eta_i) = \frac{e^{\theta}\,k\,(t/\eta_i)^{k-1}}{\eta_i(1+e^{\theta}\,(t/\eta_i)^{k})} = \frac{e^{\theta-k\log\eta_i}k\,t^{k-1}}{1+e^{\theta-k\,\log\eta_i}t^{k}}$$

Where η_i= exp $((\beta_1 x_1 + \beta_2 x_2 + \cdots + \beta_p x_p)$ for individual *i* with p explanatory variables. Therefore, the survival time for the i^{th} individual has a log-logistic distribution with parameter $\theta - k\log\eta_i$ and k, log-logistic distribution has AFT property. If the baseline survival function is $S_0(t)$=$\{1 + e^{\theta}\,\mathrm{t}^{k}\}^{-1}$, where θ and k are unknown parameters, then the baseline odds of surviving beyond time *t* are given by

$$\frac{S_0(t)}{1-S_0(t)} = e^{-\theta}\,\mathrm{t}^{-k}$$

The survival time for the i^{th} individual also has a log-logistic distribution as

$$S_i(t) = \frac{1}{1+e^{\theta-k\,\log\eta_i\mathrm{t}^{k}}} \qquad (2.28)$$

Therefore, the odds of the i^{th} individual surviving beyond time t is given by

$$\frac{S_i(t)}{1-S_i(t)} = e^{\log\eta_i-\theta}\mathrm{t}^{-k} \qquad (2.29)$$

We observed that the log-logistic distribution has the proportional odds (PO) property. So, this model also a proportional odds model, in which the odds of an individual surviving beyond time t are expressed as

$\frac{S_i(t)}{1-S_i(t)} = \exp\left((\beta_1 x_{1i} + \beta_2 x_{2i} + \cdots + \beta_p x_{pi}\right) \frac{S_0(t)}{1-S_0(t)}$.

In a two-group study, using (2.29), the log (odds) of the i^{th} individual surviving beyond time t are $\log[\frac{S_i(t)}{1-S_i(t)}] = \beta x_i - \theta - k \log t$,

Where, x_i is the value of a categorical variable that take the value 1 in one group and 0 in the other group. A plot of $log\ [(1 - S(t))/S(t)]$ versus log *t* should be linear if log-logistic distribution is appropriate. Therefore, we can check the suitability of log-logistic distribution using the PO property.

If T_i has a log-logistic distribution, then ε_i has a logistic distribution. The survival function of logistic distribution is given by $S_{\varepsilon_i}(\varepsilon) = \frac{1}{1+\exp(\varepsilon)}$.

Using equation (2.20), the AFT representation of survival function of the log-logistic model is given by

$$S_i(t) = [1 + t^{\frac{1}{\sigma}}\exp(\frac{-\mu-\alpha_1 x_{1i}- \ldots- \alpha_p x_{pi}}{\sigma})]^{-1} \quad (2.30)$$

Comparing th e formula (2.28) and (4.30), we easily found a θ=- μ/σ, k=σ^{-1}, according to the relationship of survival and hazard function, the hazard function for the *i*th individual is given by

$$h_i(t)=\frac{1}{\sigma t}\{1 + t^{\frac{1}{\sigma}}\exp(\frac{-\mu-\alpha_1 x_{1i}- \ldots- \alpha_p x_{pi}}{\sigma})\}^{-1} \quad (2.31)$$

The pth percentile of the survival distribution for the ith individual is $t_i(p)$, from equation (2.30), is

$t_i(p) = \exp[\sigma \log\left(\frac{100-p}{100}\right) + \mu + \alpha' x_i]$. The median survival time is

$t_i\ (50) = \exp\ (\mu + \alpha' x_i)$. (2.32)

3) Log-normal AFT Model: When the survival times are assumed to have a log-normal distribution, the baseline survival function and hazard function are given by

$S_0(t) = 1 - \Phi(\frac{logt-\mu}{\sigma})$, $h_0(t) = \frac{\phi(\frac{logt}{\sigma})}{[1-\Phi(\frac{logt}{\sigma})]\sigma t}$, where μ and σ are parameters, ϕ (x) is the probability density function and ϕ (x) is the cumulative density function of the standard normal distribution. The survival function for the i^{th} individual is

$$S_i(t) = S_0(t/\eta_i) = 1 - \Phi\ (\frac{logt-\alpha' x_i-\mu}{\sigma}),$$

where η_i = exp $(\alpha_1 x_1 + \alpha_2 x_2 + \ ... + \ \alpha_p x_{pi})$.

Therefore, the log survival time for the i^{th} individual has normal $(\mu + \alpha' x_i, \sigma)$. The log-normal distribution has the AFT property. In a five-group study easily we could have got

$\Phi^{-1}[1 - S(t)] = \frac{1}{\sigma}(logt - \alpha' x_i - \mu)$,

where x_i is the value of a categorical variable which takes the value 1 in one group and 0 in another group, this implies that a plot of $\Phi^{-1}[1 - S(t)]$ versus $log\ t$ will be linear if the log-normal distribution is appropriate.

4) Gamma AFT Model: The gamma model means the generalized gamma model in this paper. The probability density function of the generalized gamma distribution with three parameters λ, α and γ is defined by

$$f(t)=\frac{\alpha\lambda^{\alpha\gamma}}{\Gamma(\gamma)} t^{\alpha\gamma^{-1}} \exp[-(\lambda t)^{\alpha}] \qquad t>0, \gamma > 0,\ \lambda > 0, \alpha > 0,$$

Where, γ is the shape parameter of the distribution. The survival function and hazard function do not have a closed form for the generalized gamma distribution. The exponential, Weibull and log-normal models are all special cases of the generalized gamma model. It was easily to see this generalized gamma distribution became the exponential distribution if α= γ=1, the Weibull distribution if γ = 1, and the log-normal distribution if $\gamma \longrightarrow \infty$. The

generalized gamma model can take on a wide variety of shapes except for any of the special cases.

5) Model checking: The graphical methods could be used to check if a parametric distribution fits the observed data specifically, if the survival time follows an exponential distribution, a plot of $\log[-\log S(t)]$ versus $\log t$ should yield a straight line with slope of 1. If the plots are parallel but not straight, then PH assumption holds but not the Weibull. If the lines for two groups are straight but not parallel, the Weibull assumption is supported but the PH and AFT assumption are violated. The log-logistic assumption can be graphically evaluated by plotting $\log\left[\frac{1-S(t)}{S(t)}\right]$ versus $\log t$.

   If the distribution of survival function is log-logistic, then the resulting plot should be a straight line. For the log-normal distribution, a plot of $\Phi^{-1}[1-S(t)]$ versus log t should be linear.

   Using quantile-quantile plot, an initial method for assessing the potential for an AFT model is to produce a quantile-quantile plot. For any value of p in the interval (0,100), the pth percentile was $t(p) = S^{-1}\left(\frac{100-P}{100}\right)$.

   Let $t_0(p)$ and $t_1(p)$ be the pth percentiles estimated from the survival functions of the two groups of survival data, which may be expressed as $t_0(p)= S_0^{-1}\left(\frac{100-P}{100}\right), t_1(p)= S_1^{-1}\left(\frac{100-P}{100}\right)$, where $S_0(t)$ and $S_1(t)$ are the survival functions for the two groups. So, we can get $S_1[t_1(p)]=S_0[t_0(p)]$.

   Under the AFT model, $S_1(t) = S_0(t/\eta)$ and $S_1[t_1(p)]=S_0[t_1(p)/\eta)]$. Therefore, we have got $t_0(p)=\eta^{-1}t_1(p)$.

   The percentiles of survival distributions for two or more groups could be estimated by K-M estimates of the respective survival functions. A plot of percentiles of the K-M estimated survival function for one group against

another should give an approximate straight line through the origin if the accelerated failure time model is appropriate. The slope of this line will be an estimated of the acceleration factor η^{-1}.

Using statistical criteria, we have managed use the statistical tests or statistical criteria to compare all these AFT models. Nested models have compared using the likelihood ratio test. The exponential model, Weibull model and log-normal model are nested within gamma model. For comparing models that are not nested, the Akaike information criterion (AIC) and Bayesian information criterion (BIC) can be used instead, which is defined as

$$AIC = -2l + 2(k + c),$$

$$\text{BIC}=k\ln(n)-2\ln(L),$$

Where k = model degrees of freedom, N = number of observations.

The BIC generally penalizes free parameters more strongly than the Akaike information criterion, though it depends on the size of n and relative magnitude of *n* and *k*.

Regardless of model, the problem of defining N never arises with AIC because *N* is not used in the AIC calculation. AIC uses a constant 2 to weight complexity as measured by k, rather than ln(N). For both AIC and BIC, however, the likelihood functions must be conformable; that is, they must be measuring the same event.

AIC is the best for prediction as it is asymptotically equivalent to cross-validation, while BIC is the best for explanation as it is allowing consistent estimation of the underlying data generating process.

Where l is the log-likelihood, k is the number of covariates in the model and c is the number of model specific ancillary parameters, the addition of $2(k + c)$ can be thought of as a penalty if non-predictive parameters are added to the model. Lower values of the AIC suggested a better model.

When two models have very similar AIC values, the choice of model may be hard, and external model checking or previous results may be required to judge the relative plausibility of the models rather than relying on AIC values alone. Procedures based on residuals in the AFT model are particularly relevant with the Cox PH model. One of the most useful plots is based on comparing the distribution of the Cox-Snell residuals with the unit of exponential distribution. The Cox-Snell residual for the *i*th individual with observed time t_i is defined as $r_{c\ i}=\widehat{H}(t_i/X_i)$ = -log $[\hat{S}(t_i/X_i)]$,

Where t_i is the observed survival time for individual i, X_i is the vector of covariate values for individual i, and $\widehat{S}(t_i)$ is the estimated survival function on the fitted model. From equation (2.20), the estimated survival function for the *i*th individual is given by $\hat{S}_i$(t)= $S_{\varepsilon_i}(\frac{logt-\hat{\mu}-\hat{\alpha}X_{\ i}}{\hat{\sigma}})$,

Where $\hat{\mu}$, $\hat{\alpha}$ and $\hat{\sigma}$ are the maximum likelihood estimator of μ, α and σ respectively, $S_{\varepsilon_i}(\varepsilon)$ is the survival function of ε_i in the AFT model, and $(\frac{logt-\hat{\mu}-\hat{\alpha}X_{\ i}}{\hat{\sigma}})=r_{s_i}$ is referred to as standardized residual.

The Cox-Snell residual can be applied to any parametric model, the corresponding form of residual based particularly AFT model can be obtained under the Weibull AFT model, since $S_{\varepsilon_i}(\varepsilon)$= exp (- e^{ε}), the Cox-Snell residual is then

$$r_{c_i}=-\log\{\hat{S}(t_i)\} =-\log S_{\varepsilon_i}(r_{s_i})= \exp(r_{s_i}).$$

Under the log-logistic AFT model, since $S_{\varepsilon_i}(\varepsilon)= (1 + e^{\varepsilon})^{-1}$, the Cox-Snell residual is then

$$r_{c_i} = \log[1 + \exp(r_{s_i})].$$

If the fitted model is appropriate, the plot of log (-log S(r_{c_i})) versus log r_{c_i} is a straight line with unit slope through the origin. These residuals led to the

deviance residuals for the particularly AFT model. A plot of deviance residuals against the survival time or explanatory variables could be used to check whether the times or values of explanatory variables, for which the model is not a good fit.

Table (2.4): Comparison of Cox PH model and AFT model

	Cox PH Model	AFT Model
Advantage	1. Widely used. 2. No assumption about the distribution for the survival time. 3. Survival curves can be estimated after adjusting for the explanatory variables. 4. Incorporation of time-dependent covariate is convenient using SAS software	1. More informative. predicted hazard functions, predicted survival functions, median survival times and time ratios can be obtained. 2. The effect of covariate is to accelerate or delay the duration of illness by a constant amount (acceleration factor or time ratio). 3. The effect size is time ratio which is easier to interpret and more relevant to clinician
Disadvantage	1. PH assumption must hold. 2. Effect size is hazard ratio which is less relevant to clinician.	1. Relatively unfamiliar and rarely used. 2. AFT assumption must hold. 3. Need to specify the distribution of survival time, but an appropriate distribution may be difficult to identify. 4. Incorporation of time-dependent covariate is not allowed using SAS software

Source: Jiezhi Qi, Mar. 2009

Probability Density Function in relation to Hazard and Survival function. In parametric models, methods of estimation and inference based on the likelihood are easy and straightforward but based on the stronger assumptions as compared to semiparametric and assumptions free nonparametric models. Choosing a theoretical distribution that fits the data well is an art, the idea of this research is not to describe the art but, to discuss some familiar survival distributions. A detailed description of the parametric methods of Survival analysis was discussed by (Lawless, 1982).

The commonly used standard distributions in most cases are not suitable to survival data. Exponential, Weibull, Gamma, Log-logistic are the most familiar survival distributions. Suppose that the survival times are observed and q of the n individuals died at times t_1, t_2,K,t_n, and $t_{(1)}$<$t_{(2)}$< K <$t_{(q)}$that the survival times of the remaining n-q (q < n) individuals are censored. If denotes the probability density function of the survival time *t* be the survival function, the likelihood function can be expressed.

Although nonparametric estimation is more widely used, it is still necessary to discuss parametric estimation in which the distribution of the survival data is assumed known. Distributions that are commonly used in survival analysis are the exponential, Weibull, and lognormal (Allison and Paul, 1995); (Cantor and Alan,2003). Because of its historical significance, mathematical simplicity and important properties.

Chapter Three

Epidemic Diseases for Children under 5 Age

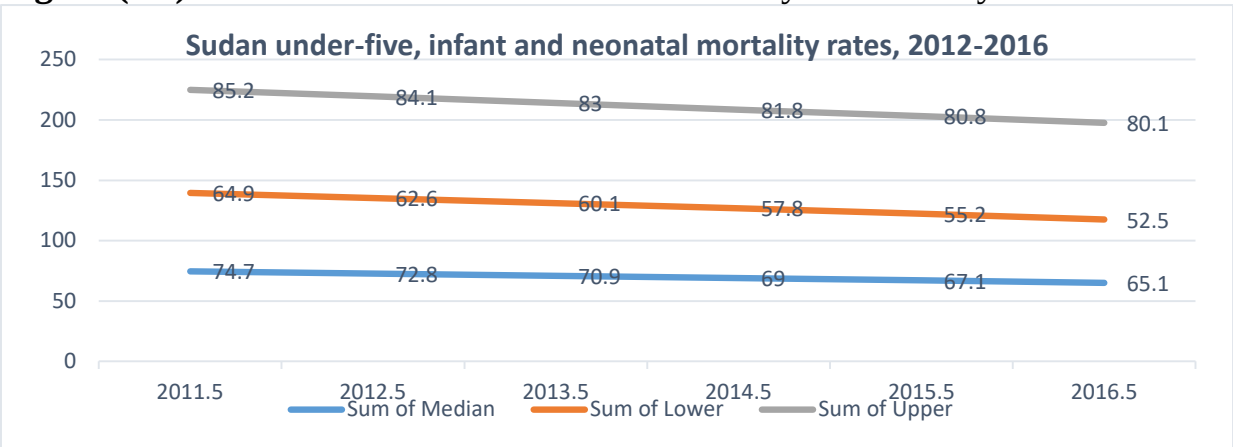
3.0 Preface

Although Sudan has various natural resources, if managed well the health rights will increase the medical resources like the developed countries. the promotion of the right to food for children is particularly at risk of food shortages and the rate of infant mortality or babies underweight at birth.

3.1 Health of Sudanese Children

The vision of Federal Ministry of Health is to build a healthy nation, with emphasis on the health needs of the poor, underserved, disadvantaged and vulnerable populations, thereby contributing to the achievement of the Millennium Development Goals and the overall social and economic development of the country. Moreover, the mission of the Ministry of health is focus on the provision of equitable and quality health services that meet Sudanese people expectations and needs, promote their health, improve their quality of life, and permits them to lead a dignified and prosperous life. This will realize by butting putting health at the center of the country development policy, using best available evidence and efficient utilization of resources.

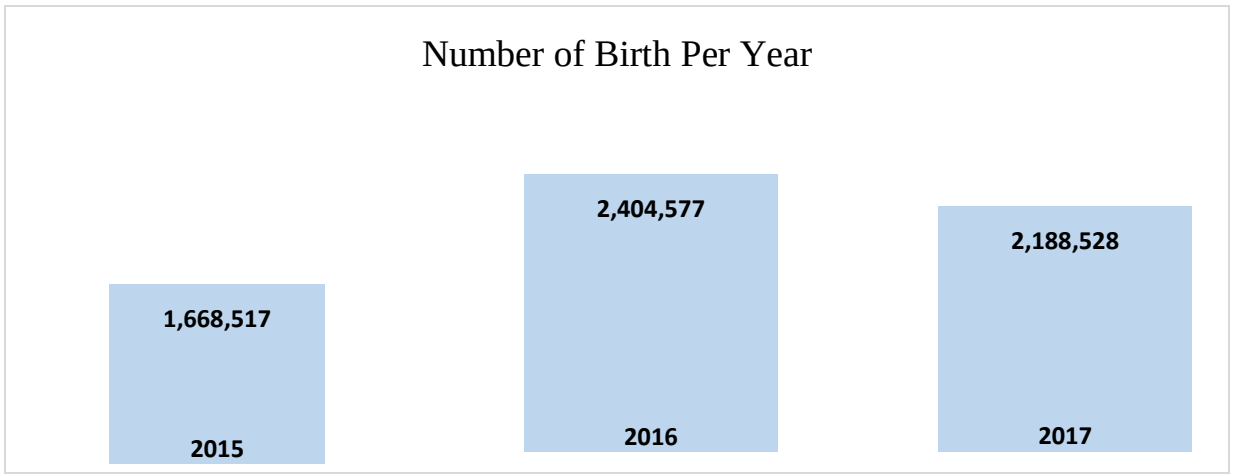
Figure (3.1): Sudanese Children under-five mortality rate for May 2011-2016



Source: https://data.uicef.org/country/sdn on 15 Sept 2018

The figure (3.1) shows the children under 5 mortality rates is decreasing slowly from study started to the end, which means more attention are needed for tangible decreasing.

Figure (3.2a): Number of Sudanese Birth from 2015-2017



Source: Civil Register, Sudan

The figure (3.2a) show the (69%) increase of the number of birth of 2015 vs. 2016 and (9%) decreased of 2016 vs. 2017.

Table (3.1): Mortality rates by age group in Sudan in 2014

Indicator	Age Group		
	10-14	5-9	0-4
Neonatal Mortality	28	28	33
Post neonatal Mortality	27	20	19
Infant morality	55	48	52
Child mortality	32	23	17
Under five mortalities	85	70	68

Source: MICS (Multi-Indicator Survey 2014), Sudan

Table (3.2): Early Childhood Mortality by Regional in 2014

Geographic area	Neonatal	Post neonatal	Infant morality	Child mortality	Under five mortalities
Sudan	32.6	19.4	52.0	17.3	68.4
Urban	30.3	14.8	45.1	11.8	56.5
Rural	33.4	21.1	54.5	19.3	72.8

Source: MICS (Multi-Indicator Survey 2014), Sudan

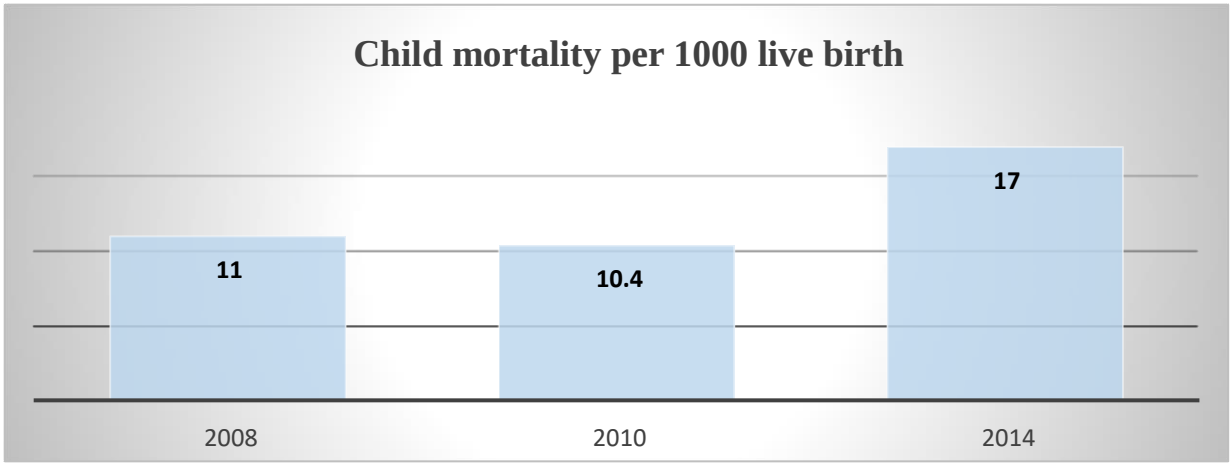
Table (3.3): Early Childhood Mortality per Sudanese States in 2014

Geographic area	Neonatal	Postneonatal	Infant mortality	Child mortality	Under five mortalities
Northern	23.0	6.9	30.0	0.0	29.9
River Nile	25.8	2.3	28.1	7.2	35.1
Red sea	18.6	25.6	44.2	17.9	61.3
kassala	47.2	15.0	62.1	19.7	80.5
Gadarif	32.6	20.8	53.4	24.6	76.7
Khartoum	30.5	14.6	45.1	4.9	49.8
Gezira	26.2	15.2	41.4	12.6	53.5
White Nile	30.3	16.5	46.8	20.0	65.8
Sinner	18.0	16.1	34.1	18.1	51.6
Blue Nile	26.0	20.8	46.8	38.9	83.9
North Kordofan	23.0	12.7	35.6	6.5	41.9
South Kordofan	32.5	37.6	70.2	27.1	95.4
West Kordofan	43.4	24.8	68.2	15.0	82.1
North Darfur	43.9	24.6	68.5	23.4	90.3
West Darfur	39.2	32.0	71.2	21.8	91.4
South Darfur	35.2	17.5	52.6	20.4	71.9

Central	24.7	19.8	44.5	34.4	77.4
East Darfur	51.8	36.7	88.5	25.5	111.7

Source: MICS (Multi Indicator Survey 2014), Sudan

Figure (3.2b): Sudanese Child mortality per 1000 live birth



Source: Civil Register, Sudan

Sudan Health policies, the systems and socioeconomics of Sudan were deteriorated because of South Sudan separation, internal conflict, inflation with no imports, loss of revenue from South Sudan for oil transportation and continuing sanctions, and a trade embargo. Due to these occurrences, funds for health have been cut, adding to the fragility of the health sector. In the past, the health financing system in Sudan has undergone several changes, from a tax-based system in the late 1950s to the introduction of user fees along with social solidarity schemes such as the *Takaful* system. The social health insurance scheme was implemented in 1995, alongside with the private sector grew exponentially leading to increased out-of-pocket from households in 2006, free emergency care for the first 24 hours was announced free of charge, and the free finance policy for children under 5 and pregnant women was adopted in 2008. Sudan has also reviewed health system financing using the OASIS approach as a prelude to frame its national strategy for health financing. Also, the country has

embarked on developing detailed roadmap for providing universal health coverage to its population.

3.2 Epidemic Diseases of Sudanese Children under 5 Years

Epidemiology is the study of disease and its causative factors. Most commonly it involves studying a population of patients to determine the frequency of a disease and how it affects that population. Epidemiology also involves the assessment of various diagnostic tests and their clinical utility in evaluating and treating disease.

Incidence, prevalence, and mortality rates have specific terms for disease occurrence, which are commonly misused. The incidence of the disease is defined as the number of new cases of the disease per unit time divided by the population at risk for the disease at the beginning of the time. The large size of some populations of interest can make accurate incidence measurements difficult and costly to obtain. The prevalence of a disease is defined as the number of individuals with the disease divided by the population at risk for the disease at a specific point in time.

$$\text{Incidence} = \frac{\text{number of new cases of disease over time}}{s\text{number of patients at risk for disease at the begining of the time } period}$$

$$\text{Prevalence} = \frac{\text{number of patients with the disease at a specific point in time}}{\text{number of patients at risk for disease at a specific point in time}}$$

Mortality rates are another aspect of epidemiology in which specific definitions are used. Mortality rates quantitate the incidence of death due to various causes in the population of interest and provide a standardized method, which to compare the frequency of death in different patient population. The crude annual mortality rate is defined as the total number of deaths in a population at risk per year divided by the size of the population at risk at mid-year. The population

size is measured at mid-year to establish an average size for the population as some patients will die early in the year while others will die late in the year.

The crude annual mortality rate is used to measure mortality from all causes over the period of the year. A more specific rate is obtained from the cause-specific annual mortality rate in which a cause of death is of interest. It is defined as the number of deaths due to the cause of interest per year divided by the size of the population at risk measured at mid-year. Occasionally, we wish to investigate the death rate due to a cause by age; the age-specific annual mortality rate is defined as the number of deaths in a given age group at risk per year divided by the size of the population at risk measured at mid-year.

$$\text{Crude annual mortality rate} = \frac{\text{total deaths in population at risk per year}}{\text{total population at risk at mid-year}}$$

$$\text{Cause-specific annual mortality rate} = \frac{\text{total deaths from cause of interest per year}}{\text{total population at risk at mid-year}}$$

$$\text{Age-specific annual mortality rate} = \frac{\text{total deaths in a given age group per year}}{\text{total population at risk at mid-year}}$$

Child health is regarded as an important growing issue globally, essential interventions are designed and if they are properly implemented they will reduce the mortality and morbidity rates among the target age group of children.

Sudan like other developing countries suffers from a high mortality rate among children under 5 years. Although there is a steady minimal reduction of this rate, but it is still high even after implementing many policies and interventions by the federal government. The aim of this work is to analyze the situation of under 5 children mortality in Sudan in term of trend, causes of death, policies and interventions undertaken to reduce this risk. Methods, the Sudan annual statistical report of 2015 was reviewed, it revealed that the trend of under 5 children mortality in Sudan was 70.10 as of 2015 and this was the lowest value, while the highest one was 178.40 in the year 1960. It has observed from (Selwa,

2018) that under 5 mortalities is the probability of dying between the age of one day to 60 months of life, it indicates not only the under 5 child health but also mothers and societies health. Causes of under 5 mortalities include: child spacing, maternal age and level education, traditional and cultural practices, vaccination coverage and economic factors in most countries.

Table (3.4): Trend in under 5 and neonatal mortality among Sudanese Children1990-2015

Years	Trend under 5 mortalities	Neonatal mortality
1990	128	41
2000	106	36
2010	80	32
2015	70	30

Source: Selwa, 2018

3.2.1 Research and global health

The global of 2017 recommendations for Preventive Pediatric Health Care, which have been approved by the American Academy of Pediatrics (AAP) and represents a consensus of AAP and the Bright Futures Periodicity Schedule Workgroup. these recommendations are designed for the care of children who are receiving competent parenting, have no manifestations of any important health problems, and are growing and developing in a satisfactory fashion (Hagan et al., 2017). The hospital's produced research in many areas such as malaria, hematology and antibiotic use Jafar Ibn Auf and the CEH before has involved in managing outbreaks of infectious diseases including diphtheria, whooping cough, and notably through an early example of molecular epidemiology, the Jafar Ibn Auf is an essential focus of medical training in the region. From its instigation in 1977 to the present day, it has had ongoing involvement with the University of Khartoum.

3.2.2 Sample of non-communicable Children diseases

This study focused in reducing the accelerated failure time addition to estimate the probability of survival time for Five non-communicable diseases, which are:

1) Acute Renal Failure (ARF), is a clinical condition, which presents acute deterioration of renal functions with or without oliguria. Causes of ARF in different countries are usually determined by geographical, environmental, socioeconomic and cultural conditions. In countries with high technology medicine, most instances of ARF occur in the hospital as part of multiorgan dysfunction syndrome (MODS), most frequently as iatrogenic complications, and are associated with high mortality (Ellis, 1982). The four Stages of Chronic Renal Disease are: The first stage of chronic renal disease coincides with a GFR of 50% to75% of normal for age. This is an asymptomatic stage. Increases in serum urea nitrogen, creatinine, and parathyroid hormone ensue only after the GFR falls below 50%of normal. The second stage of chronic renal disease generally is referred to as chronic renal insufficiency and coincides with the GFR of 25% to 50% of normal for age. Heavy, asymptomatic proteinuria of more than 1,000 mg/d often is present. Hyposthenia and nycturia also are characteristic features. Whereas infection and dehydration seldom cause significant problems in the first stage because of a wider margin of renal functional reserve, these conditions may precipitate severe azotemia in the second stage. The third stage of chronic renal disease, generally known as CRF, is related to a GFR of 10% to 25% of normal and is characterized by the clinical features of anemia, acidosis, hyperphosphatemia, and hypocalcemia as well as renal osteodystrophy and rickets. The fourth and final stage of chronic renal disease, known as end-stage renal disease, coincides with the GFR of less than 10% of normal.

Because of the severe neurologic, cardiovascular, intestinal, hematologic, and skeletal abnormalities that usher in this final stage, preparation for the initiation of dialysis and transplantation must begin as the child enters the transition into end-stage disease. Although the first two stages of CRF are distinct, the features of the last two stages overlap (Foreman and Chan, 1988).

Obstetrical Causes of ARF, contraceptive pills were available freely in Sudan till 1990. Since then these pills are supplied only in family planning centers. This restriction of availability has witnessed a marked increase in the number of cases of ARF. When these cases are complicated by ARF, which is quite common in this setting, the mortality rate is alarmingly high. Causes of ARF in late gestation, including toxemia of pregnancy, antepartum hemorrhage, post-partum hemorrhage, chloroquine-resistant malaria and puerperal sepsis, are common due to scarce or absent antenatal care in most areas of Sudan.

In conclusion, the causes of ARF in Sudan are like most developing countries, good health education regarding use of drugs and chemicals and early consultation of qualified physicians in case of any illness. The evaluation of kidney failure is challenging, despite many advances in diagnosis and treatment over the past decade. ARFs in childhood due to hemolytic-uremic syndrome, post infectious acute glomerulonephritis, or dehydration are reversible, but a small percentage may progress to CRF, which is the result of slowly progressive kidney diseases and seldom is fully reversible. This condition in childhood is associated with obstructive uropathy, congenital aplastic/hypoplastic/dysplastic kidneys, and other causes. In CRF, almost every system in the body eventually becomes compromised.

Table (3.5): Causes of Children's Acute Renal Failure in Developing Countries

Causes	Developing Country/Industrialized Country/ Referral Centre n (%)	Tertiary Centre n (%)
Haemolytic-uremic syndrome	25 (31)	5 (3)
Glomerulonephritis	18 (23)	-
Intrinsic renal disease	-	64 (44)
Urinary obstruction	7 (9)	-
Postoperative sepsis	14 (18)	49 (34)
Ischemic and prerenal	14 (18)	-
Organ and bone marrow transplant	-	19 (13)
Miscellaneous	2 (3)	9 (6)
Total	80	146

Source: (Flynn, 1998).

Although, Sudan is the leading country in Africa to start peritoneal dialysis (it started in 1968 in the adult population), children had limited access to PD and only few older children were treated by physicians until 2001. Recently (2004), a specialized pediatric nephrology unit was established at Soba University Hospital in the capital, Khartoum. This unit delivers PD, HD and kidney transplant, it is supported by the Sudan government and charity organizations. (Mohamed, 2014).

The most common causes for AKI is sepsis in contrast to the others three diseases, infections and obstructive uropathy due to stones (Sulieman, 1998).

2) Congenital heart disease (CHD) is a type of heart diseases that children are born with (Atherosclerosis, Arrhythmias, Kawasaki disease, Heart murmurs, Pericarditis, Rheumatic heart disease and Viral infections), usually caused by heart defects that are present at birth. It may have had a small hole in it or something more severe. Although these can be very serious conditions, but many could be treated with surgery. Some congenital heart defects in

children are simple and don't need treatment and others are more complex and require several surgeries performed over a year (Bernier et al., 2010).

Symptoms of CHD, Serious congenital heart defects usually become evident soon after birth or during the first few months of life. Signs and symptoms could include pale grey or blue skin color (cyanosis)**,** rapid breathing**,** swelling in the legs, abdomen or areas around the eyes, and shortness of breath during feedings leading to poor weight gain less serious congenital heart defects may not be diagnosed until later in childhood, because children may not have any noticeable signs of a problem. In many cases heart defects don't require treatment or are easily fixed. However, in serious cases or babies born with critical congenital heart disease, the heart defect can result in deadly health issues and requires immediate attention. CDH in Sudanese children under five years that had borne with a heart defect, the heart is not working properly, usually because there is something defective with the valves or the blood vessels around the heart. The defect can keep blood from flowing normally and can affect heart development.

3) Leukemia is a cancer of the cells, which develop into blood cells. There are different types of leukemia. Most children with leukemia have either acute lymphoblastic leukemia or acute myeloid leukemia. The prognosis for children with leukemia is usually very good and most children are cured. This leaflet gives a general overview of childhood leukemias. Leukemia is the most prevalent type of cancer in children. Leukaemia categorized into four types: myelogenous or lymphocytic, each of which could be acute or chronic: Acute Lymphocytic Leukaemia(ALL); Chronic Lymphocytic Leukaemia(CLL); Acute Myelogenous Leukaemia(AML) and Chronic Myelogenous Leukaemia (CML) (Wiernik, Peter H, 2001).

Table (3.6): Leukemia in Sudanese Children under Five Years in Oct 2017

Death	%	Rate	World Rank of Sudan
1,082	0.40	4.61	52

Source: WHO.org, Oct 2017

Table (3.6) shows the latest WHO data published in 2017, due Leukaemia death in Sudan reached 1,082 or 0.40% of total deaths. The age adjusted death rate is 4.61 per 100,000 of population ranks Sudan #52 in the world (Oct 2017).

4) Septicaemia is another term used to describe blood poisoning. It is an infection caused by large amounts of bacteria entering the bloodstream. It is a potentially life-threatening infection that affects thousands of patients every year (Powars et al., 1942).

   Neonatal sepsis is one of the important causes of neonatal morbidity and mortality particularly in the developing countries (Osrin *et al*., 2004). Neonatal sepsis is classified into early or late according to the different ages at onset of infection during the neonatal period (Kliegman et al.,2011). The clinical relevance of this distinction is that early-onset disease is often due to organisms acquired during delivery while, late-onset disease is more frequently caused by organisms acquired from nosocomial or community sources (Robinson et al.,2008). Most of the estimated 4 million neonatal deaths per year occur in low and middle-income countries. Case fatality rates for neonatal infections remain high among both hospitalized newborns and those in the community (Qazi and Stoll, 2009). It is often a result of another infection in the body. Bacteria from that infection can enter the bloodstream and spread throughout the body. Septicaemia in Sudanese Children under Five Year see (Abdelmoneim, 2014).

Table (3.7). Distribution of signs of sepsis of the study population

Signs	Frequency	Percent (%)
Cyanosis	8	12.9
Tachypnoea	43	69.4
Apnoea	4	6.5
Seizures	3	4.8
poor capillary refill	2	3.2
temperature instability	7	11.3
abdominal distention	12	19.4
Purpura	4	6.5

Source: Abdelmoneim, 2014

Table (3.8): Relation between the blood culture and C-reactive protein

Blood culture * CRP	CRP		Total
	+ve	-ve	
+ve	17	21	38
	44.7%	55.3%	100%
	48.6%	77.8%	61%
-ve	18	6	24
	75.0%	25.0%	100%
	51.4%	22.2%	39%
Total	35	27	62
	56.5%	43.5%	100%
	100.0%	100.0%	100%

Sig = 0.019; Source: (Abdelmoneim, 2014)

5) Sickle cell disease is an inherited blood characterized by defective hemoglobin (a protein in red blood cells that carries oxygen to the tissues of the body). Sickle cell only live for about 10 to 20 days, while normal hemoglobin can live up to 120 days. Also, Sickle Cell risk being destroyed by the spleen because of their shape and stiffness. Due to the decreased number of hemoglobin cell circulating in the body, a person with SCD is chronically anemic. The spleen also suffers damage from the sickled cells blocking healthy oxygen carrying cells and typically infants in the first few years of life. Without a normal functioning spleen, these individuals are more

at risk for infections. Infants and young children are at risk for life-threatening infection (Majdi, 2014).

3.3 Sudanese Children Mortality

Also known as child death, refers to the death of children under the age of 14 and encompasses neonatal mortality, under-5 mortality, and mortality of children aged 5 to 14. Many child deaths go unreported for a variety of reasons, including lack of death registration and lack of data on child migrants. Without accurate data on child deaths cannot fully discover and combat the greatest risks to a child's life (Liu, 2000).

Reduction of child mortality became goal in several Humanitarian Agencies through Sustainable Development Goals. Rapid progress has resulted in a significant decline in preventable child deaths since 1990, with the global under-5 age mortality rate declining by over half between 1990 and 2016.Measurement of children mortality refers to number of child deaths under the age of 5 per 1000 live births. However, the child mortality can be simplify into more specific term such as, Prenatal mortality rate: Number of child deaths within first week of birth divided by total number of birth; Neonatal mortality rate: number of child deaths within first 28 days of life divided by total number of birth; Infancy mortality rate: number of child deaths within first 12 months of life divided by total number of birth; Under 5 mortality rates: number of child deaths within 5^{th} birthday divided by total number of birth (John Robert, 1944). The global leading causes death of children under five are: (18%) preterm birth complications, (16%) pneumonia, (12%) intrapartum-related events, (7%) neonatal sepsis, (8%) diarrhoea, (5%) Malaria,(34%) Malnutrition(*https://en.wikipedia.org/wiki/Child mortality*, visited on Oct 2018).

The child survival rate of nations varies with factors such as fertility rate and income distribution; the change in distribution shows a strong correlation between child survival and income distribution as well as fertility rate, where increasing child survival allows the average income to increase as well as the average fertility rate to decrease. (source: "UNICEF child mortality statistics". UNICEF. Retrieved 4 April 2018) & Infant mortality from the Central Inelegancy Agency (CIA) World Factbook

Table(3.9): Infant mortality (deaths/1,000 live births)–2016 and 2017 estimation

Country of territory	CIA. 2016 estimates	CIA. 2017 estimates
Sudan	50.2	48.8

Sources: https://en.wikipedia.org/wiki/List_of_countries_by_infant_and_under-five_mortality_rates

3.4 Jafar Ibn Auf Pediatric Hospital

Location and patient words and healthy units of Jafar Ibn Auf Pediatric Hospital, Khartoum, the inauguration of the project took place in 1977 under the supervision of Professor Jafar Ibn auf Suliman and the Federal Ministry of health, with assistance from UNICEF, its Nonprofit hospital, affiliated by Khartoum University with around 200 beds. The hospital was originally opened as the Children's Emergency Hospital (CEH) which later evolved into 16 wards, a pharmacy, radiology department, nutritional rehabilitation and vaccination units, administration, records and statistics units. it services patients from various Sudanese states and border countries, moreover, it is one of the largest children's hospital in Sudan and incorporates many of the pediatric subspecialties including respiratory medicine, neurology, gastroenterology, cardiology, nephrology, infectious disease, pediatric intensive care and neonatal intensive care. It was one of the first dedicated children's hospitals in Africa.

Chapter Four

4.1 Methodology

This research looking for another method to modelized survival data in the presence of large censored data. This section has discussed the research design, sample of population and sampling technique used, instrument for data collection, administration of the instrument and method of data analysis.

The methodology used to estimate the heavy censored of data is, the samples for survival rate with a good prognostic indicator of 1098 child<5 years. the following information of 1098 patients are studied as: 1) the children had been hospitalized from 2012-2016 at pediatric hospital; 2) the children had records in the archives of the hospital, addresses and contacts are available for subsequent follow-up. The survival time of patients was determined after surgery till the end of study period or those not available after a specific time-period of censored. Statistical packages used for analysis are SPSS, NCSS, XLSTAT and Stata using nonparametric test to estimate the probability of survival that calculated the distributions of K-M, WKM and MWKM & Semiparametric tests (AFT and PH) are used to evaluate the risks associated with children mortality in five diseases as in significantly function of the variables (P<0.05).However, the MWKM vs. WKM and AFT vs. PH shown the significant result in dealing with heavy-censored data and provided appropriate model that well described hazard and cumulative hazard function.

4.1.1 Description of Enhanced Selective Acknowledgements

The techniques that used in this study are nonparametric, semiparametric and parametric methods. The population sample collated comprehensively as secondary data from the statistical unit at *Jafar Ibn Auf Pediatric Hospital* as

primary source, the standard records used is survival indicators of the children under five years, the cross-check has done with Ministry of Health and Central Bureau of Statistics. The selected groups, the first group is dependent variable as Survival Time and the second group is independence variables (gender; age address; stage; symptoms disease type; treatment; disease history; height (cm); weight (kg); Freq. of visits; status - events or censored (study end without got event/withdraw/lost to follow-up).

Table (4.1): Quartile Statistics

	N	Percentiles		
		25th	50th (Median)	75th
Survival Time (in day)	1098	7.00	16.00	74.00
Disease Type	1098	3.00	4.00	5.00

Source: calculated by researcher used Stata

Table (4.2): Diseases Rank

	Disease Type	N	Mean Rank
Survival Time (in day)	Acute Renal Failure	100	496.14
	Congenital Deformity Heart	104	450.02
	Leukemia	98	670.44
	Septicaemia	483	450.72
	Sickle cell disease	313	714.16
	Total	1098	2781.48

Source: calculated by researcher used Stata

Table (4.3): Rank test of group variables using Kruskal Wallis

	Gender	Age	Address	Child condition initial visit to hospital	Symptoms	Disease History	Child Hight (cm)	Child Weight (kg)	Frequency of Hospital Visits	Status
Chi-Square	5.33	752.43	24.18	0.00	39.18	0.00	165.58	508.72	211.07	84.49
Df	4	4	4	4	4	4	4	4	4	4
Asymp. Sig.	0.256	0.00	0.00	1.00	0.00	1.00		0.00	0.00	0.00

Source: calculated by researcher used SPSS

Table (4.3) show the rank test of 7 out 10 variables that have a significant risk associated to the 5 diseases, while gender, Child condition in initial visit to hospital and Disease History haven't direct risk associate.

Table (4.4a): Median Test Frequency

		Disease Type				
		Acute Renal Failure	Congenital Deformity Heart	Leukemia	Septicaemia	Sickle cell disease
Survival Time	> Median	43	36	69	176	217
	<= Median	57	68	29	307	96

Source: calculated by researcher used Stata

Table (4.4a) show the frequency of children survival time that greater or less/equal to the median survival time (16 days) per disease type.

Table (4.4b): Test Statistics for disease type

	Survival Time (day)
N	1098
Median	16
Chi-Square	110.229
Df	4
Asymp. Sig.	.000

Chi square test for 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 48.3. Source: calculated by researcher used SPSS

Table (4.4c): Test of variables median

	Gender	Age	Address	Child condition in initial visit to hospital	Symptoms	Disease History	Child Hight (cm)	Child Weight (kg)	Frequency of Hospital Visits	Status
N	1098	1098	1098	1097	1098	1098	755	1076	1093	1098
Median	1.00	120.00	53.00	2.00	1.00	2.00	48.00	3.30	1.00	.00
Chi-Square	5.330	732.76	43.12		39.21		195.91	391.74	211.62	84.57
Df	4	4	4		4		4	4	4	4
Asymp Sig.	.26	.00	.00		.00		.00	.00	.00	.00

Source: calculated by researcher used SPSS

Table (4.4cb) is expressing Table (4.4a) such as expected frequencies less than 5 and the minimum expected cell frequency as followed: 41.9 for gender, 48.4 for age, 47.8 for address, 19.9 for symptoms, 26.9 for Child Hight (cm), 47 for child weight (kg), 18.6 for Frequency of Hospital Visits. While for disease history values are less than or equal to the median and cannot be performed, because the valid cases are not enough to perform the Median Test for Disease History * Disease Type & Child condition in initial visit to hospital * Disease Type for (Acute Renal Failure, Sickle cell disease).

4.2 Statistical Analysis

The analysis conducted through different statistical packages. In all analysis terms, the survival time S(t) was treated as dependent variable (Y) while the other measurements are the independent variables (X_i). 5 diseases have been more prevalent in Sudanese children and led to the significant morbidity and mortality. Understanding that children with these diseases are presented differently than adults and often present with unique risk factors that optimize outcomes in children (Belson et al. 2007). Despite an increased incidence of paediatric, there was a delay in diagnosis and cases may remain under or misdiagnosed. Clinical presentation will vary based on the child's age, which mean children's risk factors are less common than in adults (Shafiq et al.,2007). One of the most important prognostic indicators are considered after diagnosis and treatment for patients was increased in survival rate, particularly in the Sickle cell disease. Different methods have been designed to estimate the survival rate in the previous studies, but in this study the two methods used are MWKM and AFT methods. Those methods are severely affected by censoring assumption, so if patients followed the time that they have censored, the rate of occurrence of the event among them became same as those subjects who are not

censored at that time-we could say that the censoring has occurred randomly and independent of the event (Young et al., 1999). The reliability of Kaplan Meier estimations is affected by censoring assumption (Murray, 2001) and (Zare, 2013). The study terminated with large number of censored, due to patient's loss follow up, withdrawal and alternative outcome than the focused event. High levels of censoring could suggest several problems in the study such as large number of censored observations make the survival estimations contain error and be estimated higher than real amounts. To modify Kaplan-Meier estimations, *Jan* and his colleagues presented a method named Weighted Kaplan-Meier (Jan et al., 2005) and (Kim et al., 2006). Their study revealed that if there is high censorship (i.e. 27% censorship in their study, they said K.M is not suitable), however, in this study the censorship was 79% which means K.M is not suitable too, the estimations have contained an error, and the estimated amounts were more than actual. Other methods were also presented by (Shafiq et al.,2007) and (Huang et al., 2008) to resolve the problem of Kaplan-Meier unreliable estimations. *Ramadurai* and his colleagues, have investigated and reported all methods and procedures that proposed to estimate the survival function up to the time of study. The results showed that Weighted Kaplan-Meier was semi suitable method to estimate such survival probability in (Ramadurai and Ponnuraja, 2011). While this study aimed to determine survival, probability using the MWKM as an alternative method to deal with the heavy of censorship. Computer Software used in applying the analysis are SPSS, S Plus, SAS, STATA BMDP, NCSS and XLStat.

4.3 Survival Analysis

Survival analysis is a branch of statistics for analysing the expected duration of time until one or more events happen such as death in biological organisms and failure in mechanical systems. Although mortality rates allow us to characterize

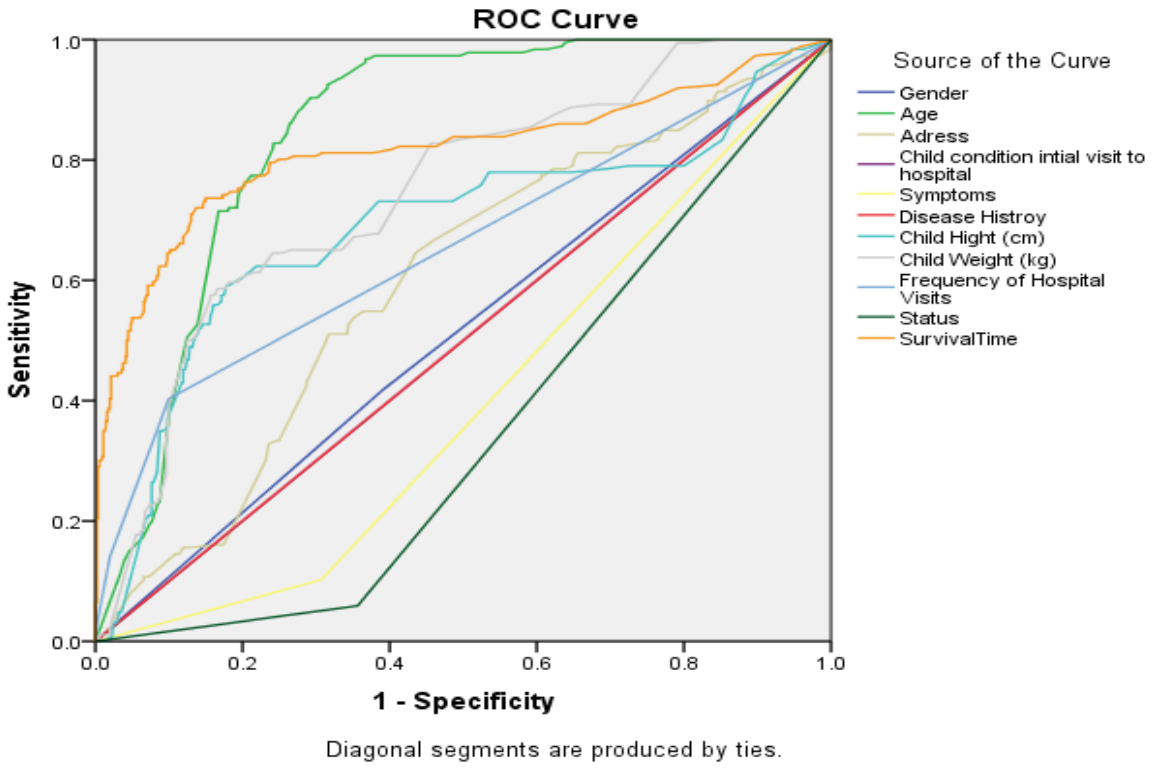
the occurrence of death in a population per year, they do not provide us with information on the natural progression of the disease process. To obtain such information, special methods of analysis are required and known by the terms survival analysis, actuarial analysis, or life-table analysis. These methods are used to follow patient groups to determine the effect of time on the natural progression of the disease process.

Receiver Operating Characteristic (Roc) Curves, a statistical method which avoids the problems associated with the use of sensitivity and specificity is receiver operating characteristic (ROC) curve analysis. It is being used more and more frequently in the medical literature. As we have seen, to improve a test's sensitivity, we must frequently accept a decrease in specificity due to the way in which we define disease. One way to demonstrate this relationship is to construct the ROC curve for the test. This curve plots sensitivity (the true positive fraction) against 1 - specificity (the false positive fraction).
All possible decision of thresholds for the test and calculation of the sensitivity and specificity at each point is determined. After plotting the sensitivity and 1 - specificity for each decision threshold, then we can choose the sensitivity that maximizes the specificity and identify the decision threshold for that point. Once the curve is plotted, we also calculated the area under the ROC curve and is used as a measure of the test's usefulness. Since the perfect diagnostic test has a sensitivity of "1" and a specificity of "1", then the perfect ROC curve has an area under the curve of "1". In comparing two diagnostic tests, the test with the largest area under the ROC curve will have the fewest false positives and false negatives. By comparing the area under each test ROC curve and determining whether they are statistically different, one diagnostic test can be compared with another irrespective of the decision thresholds utilized for each test. For every

possible cut-off point or criterion value that has selected to discriminate between the two groups, there will be some cases with the disease correctly classified as positive (TP = True Positive fraction), but some cases with the disease will be classified negative (FN = False Negative fraction). On the other hand, some cases without the disease will be correctly classified as negative (TN = True Negative fraction), but some cases without the disease will be classified as positive (FP = False Positive fraction).

- True positive: Sick children correctly identified as sick
- False positive: Healthy children incorrectly identified as sick
- True negative: Healthy children correctly identified as healthy
- False negative: Sick children incorrectly identified as healthy

Figure (4.1): Receiver Operating Characteristic Sensitivity/Specificity



Source: charted by researcher using SPSS

Figure (4.1) show gender, child condition in initial visit to hospital, disease history and status variables were in diagonally with contrast to the rest variables. In a Receiver Operating Characteristic (ROC) curve the true positive rate (Sensitivity) is plotted in function of the false positive rate (1-Specificity) for different cut-off points. Each point on the ROC curve represents a sensitivity/specificity pair corresponding to a decision threshold. A test with perfect discrimination has a ROC curve that passes through the upper left corner. Therefore, the closer the ROC curve is to the upper left corner, the higher the overall accuracy of the test (Zweig & Campbell, 1993).

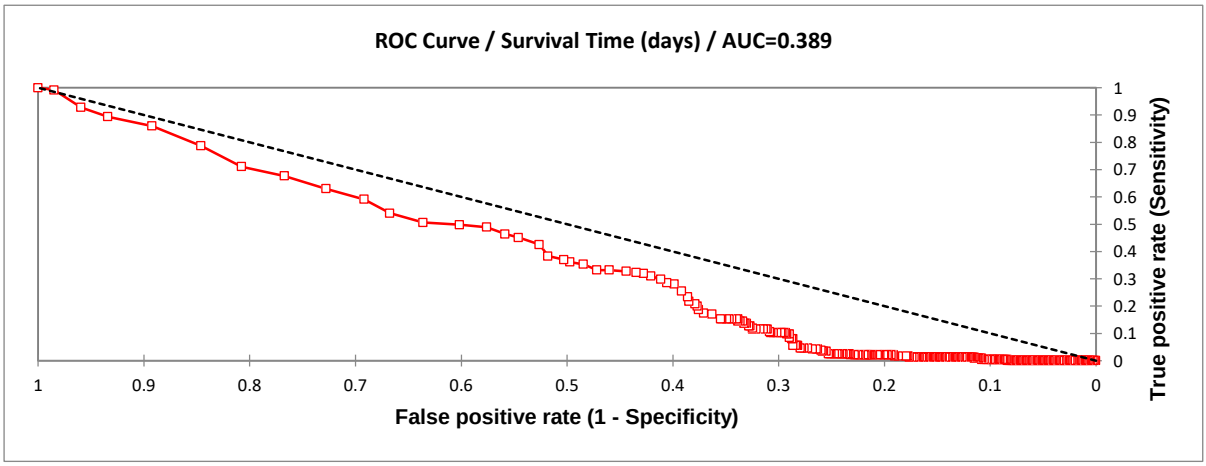
Table (4.5): % of Survival Time of Children under 5 years

Status	Frequency	%
Censored	863	79%
Died	235	21%
Prevalence	0.214	21%

Source: calculated by researcher used Stata

Test is positive if Survival Time (days) > threshold value. Larger values of the test result variable(s) indicate stronger evidence for a positive actual state. The positive actual state is death. Table (4.5) above show the frequency, percentage of heavy censored and events of the children under study.

Figure (4.2): The negative specificity of the survival time

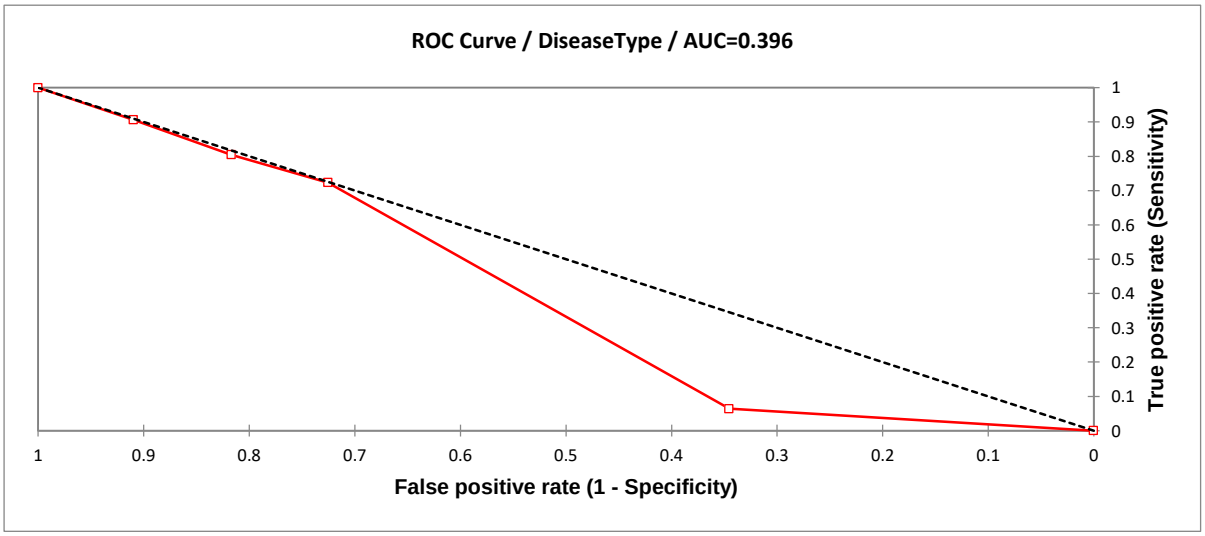


Source: charted by researcher using XlStat

The figure (4.2) is explained the Survival Time has at least one tie between the positive actual state group and the negative actual state group. The smallest cut-off value is the minimum observed test value minus 1, and the largest cut-off value is the maximum observed test value plus 1. All the other cut-off values are the averages of two consecutive ordered observed test values. In comparing two diagnostic tests, the test with the largest area under the ROC curve will have the fewest false positives and false negatives, which mean

- False positive: Healthy children incorrectly identified as sick and
- False negative: Sick children incorrectly identified as healthy

Figure (4.3): The sensitivity of the diseases type



Source: charted by researcher using XlStat

The figure (4.2) is explained the specificity probability of the sample of diseases at the Area Under Curve (AUC=0.396). Since the perfect diagnostic test has a sensitivity of 1.0 and a specificity of 1.0, then the perfect ROC curve has an area under the curve of 1.0. In comparing two diagnostic tests, the test with the largest area under the ROC curve will have the fewest false positives and false negatives, which mean:

- True positive: affected children correctly identified with 1 of 5 diseases
- True negative: Healthy children correctly identified as healthy

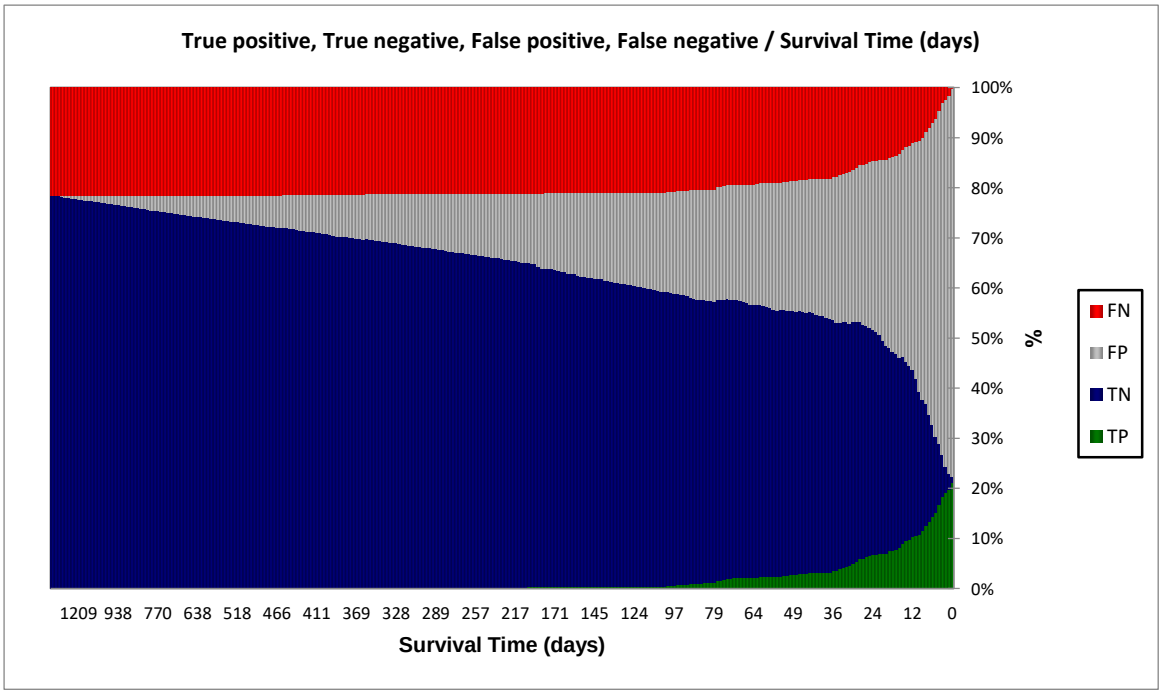
Table (4.6): ROC analysis of sensitivity and specificity for the disease

Disease Type	Sensitivity	Lower bound (95%)	Upper bound (95%)	Specificity	PPV	NPV	TP	TN	FP	FN	Sensitivity+ Specificity	Accuracy
1	0.91	0.86	0.94	0.09	0.21	0.78	213	78	785	22	0.1	0.27
2	0.8	0.75	0.85	0.18	0.21	0.78	189	158	705	46	0.99	0.32
3	0.72	0.66	0.78	0.28	0.21	0.79	170	237	626	65	0.1	0.37
4	0.06	0.04	0.1	0.66	0.05	0.72	15	565	298	220	0.72	0.53
5	0	0	0.02	1		0.79	0	863	0	235	1	0.79

Source: calculated by researcher used XlStat

Table (4.6) prove that the censored children correctly identified as censored (TN) and denied the children death with incorrectly identified as censored (FN)

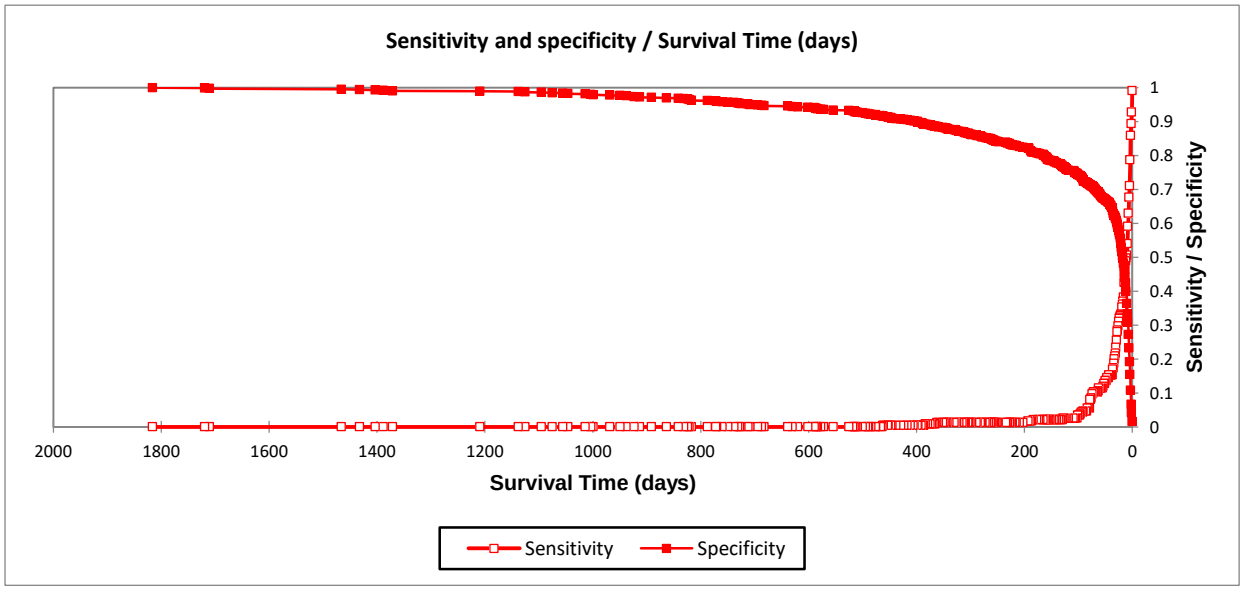
Figure (4.4): The probabilities of the Survival time



Source: charted by researcher using XlStat

Figure 4.4, shown Four types of colors, the green color explained the Child health was appeared in well condition from admitted day by 20% of true positive to survive (live) then health deteriorated down till day's 389, while the blue color shown that from day's 389 until the end of the study there was around 79% of true negative survive of children (censored with possibility till study end without got event, withdraw or lost to follow-up). Grey color show that from the first day of child admission until the end of the study there was 99% of false positive for child to recover (due to risk factors), the red color shown that 21% of false negative to survive decreasingly (died).

Figure (4.5): Sensitivity and specificity of survival time



Source: charted by researcher using XlStat

The figure (4.5) show that the probability of children sensitivity was decreased proportionally when child survival time is increased, while the probability of specificity was increased when the child recovery time decreased.

Table (4.7a): Area under the curve (AUC)

AUC	Standard error	Lower bound (95%)	Upper bound (95%)
0.389	0.021	0.347	0.431

Source: calculated by researcher used XlStat

Comparison of the AUC to 0.5, 95% confidence interval on the difference between the AUC and 0.5 were]-0.1526 , -0.0686[

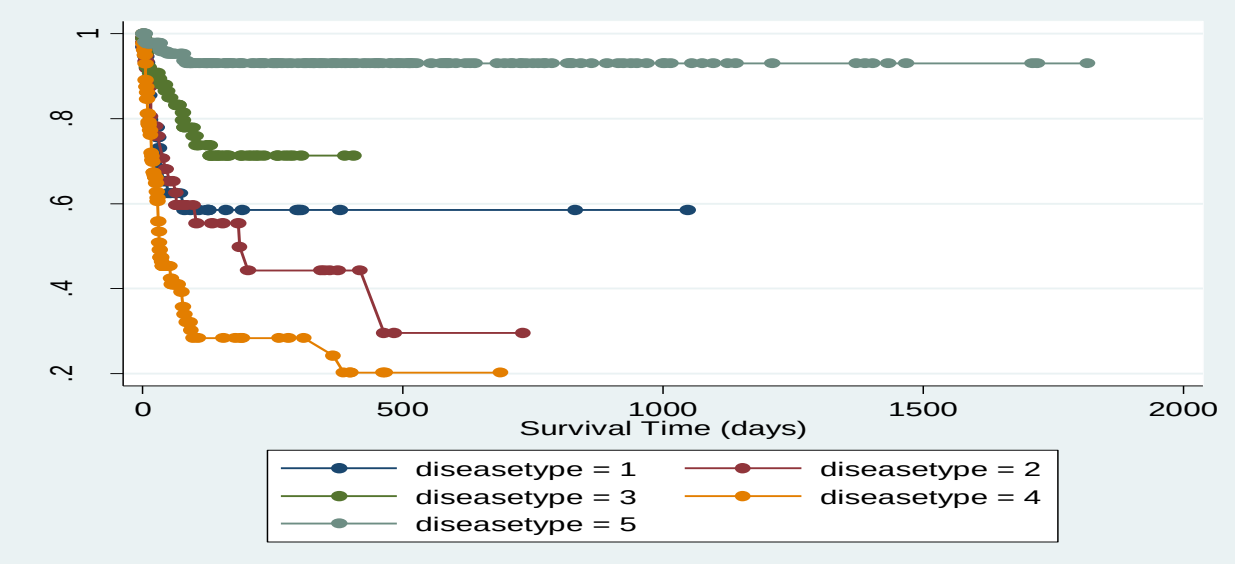
Table (4.7b): AUC null hypothesis test

Difference	-0.111
z (Observed value)	-5.164
z (Critical value)	1.960
p-value (Two-tailed)	< 0.0001
Alpha	0.05

Source: calculated by researcher used Stata

Test interpretation H_0: The AUC is equal to 0.5 or H_a: The AUC is different from 0.5. As the computed p-value is lower than the significance level α=0.05, the null hypothesis should have rejected H_0, and accept the alternative hypothesis H_a.

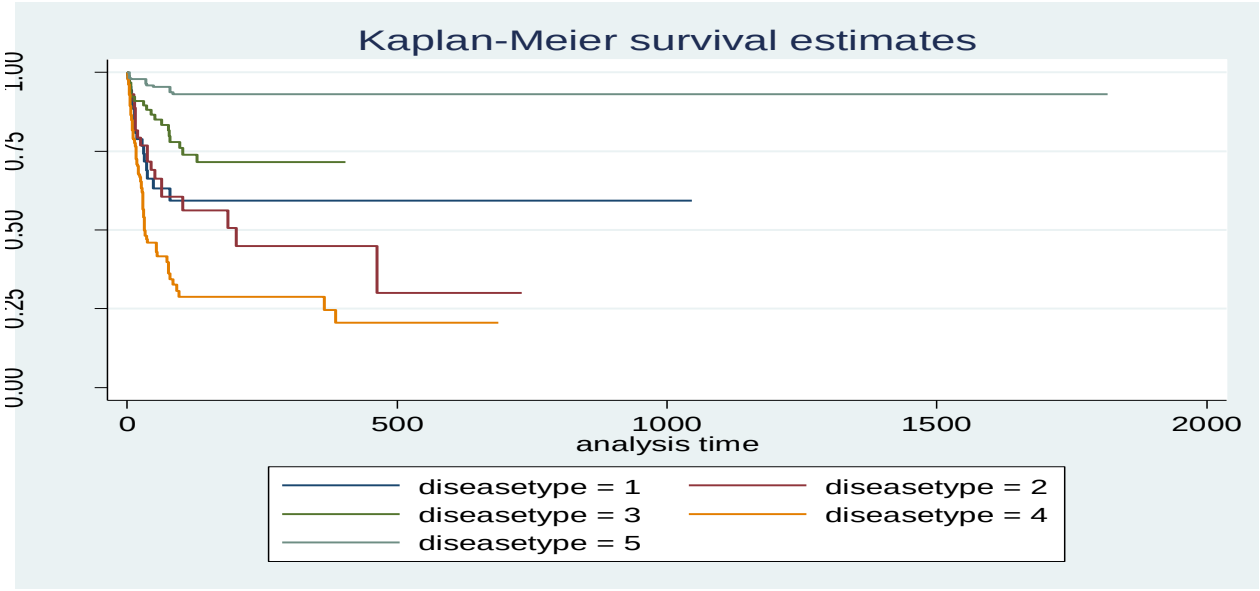
Figure (4.6): Life table for the Survival data



Source: charted by researcher using XlStat

Figure (4.6) shows the proportion surviving time of the five children groups using life table Life time is the technique, in which the series of time intervals are formed in such a way that only one death occurs in each interval time and the death occurs at the beginning of the interval.

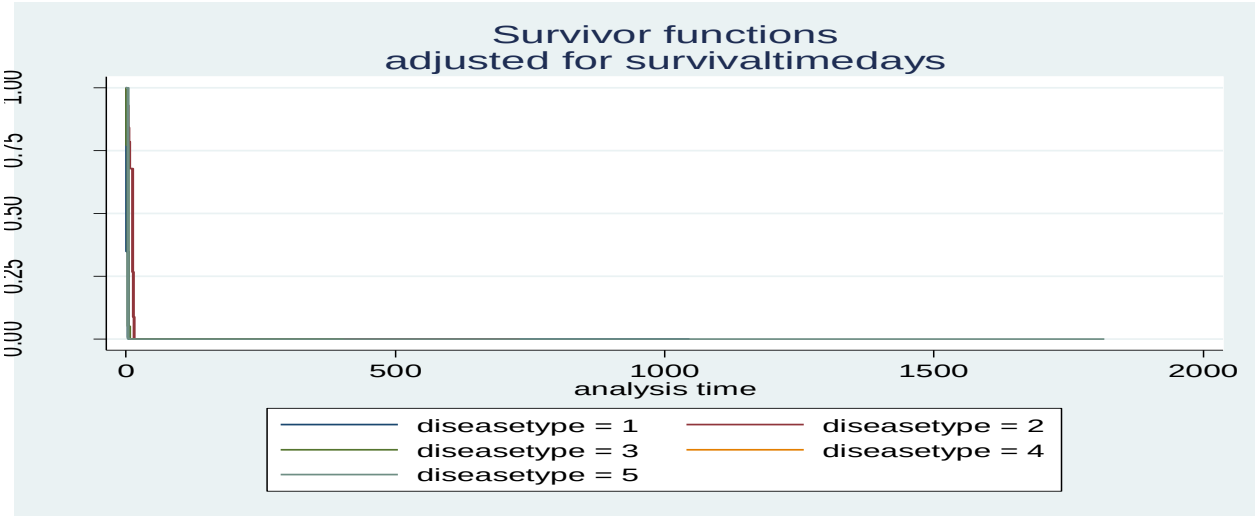
Figure (4.7): Survival Distribution Function by K.M



Source: charted by researcher using XlStat

Figure (4.7) K.M is face of life table and suitable method to estimate the survival probability for data without heavy censoring.

Figure (4.8): Survival distribution function using adjusted K.M

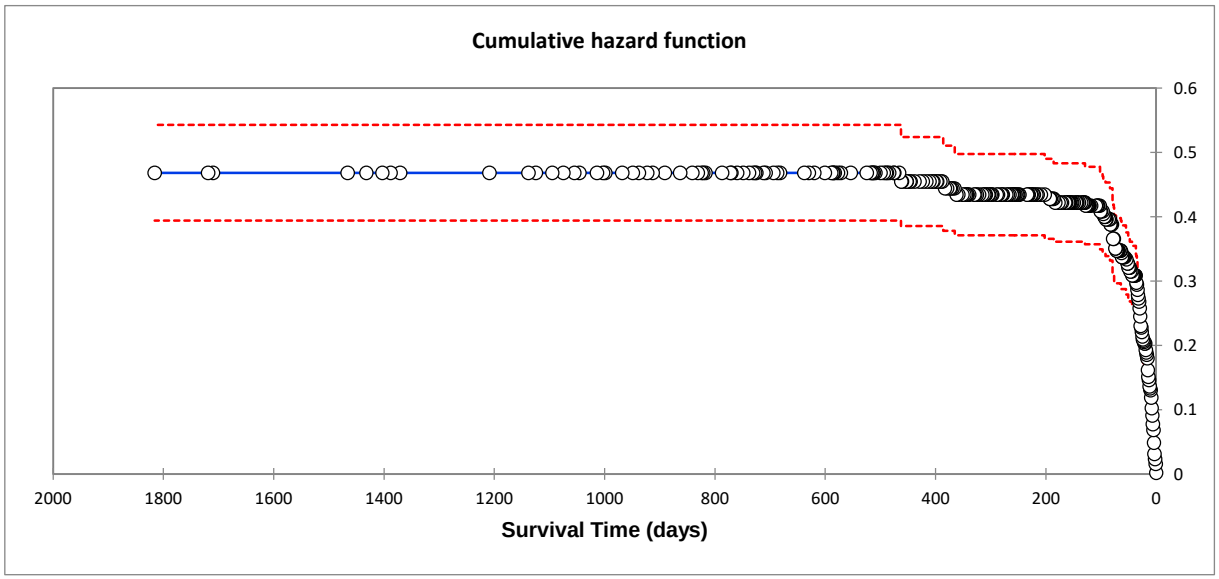


Source: charted by researcher using XlStat

Figure (4.8) show that the adjusted K.M is suitable method to estimate the survival probability for data with heavy censoring but, the last censored

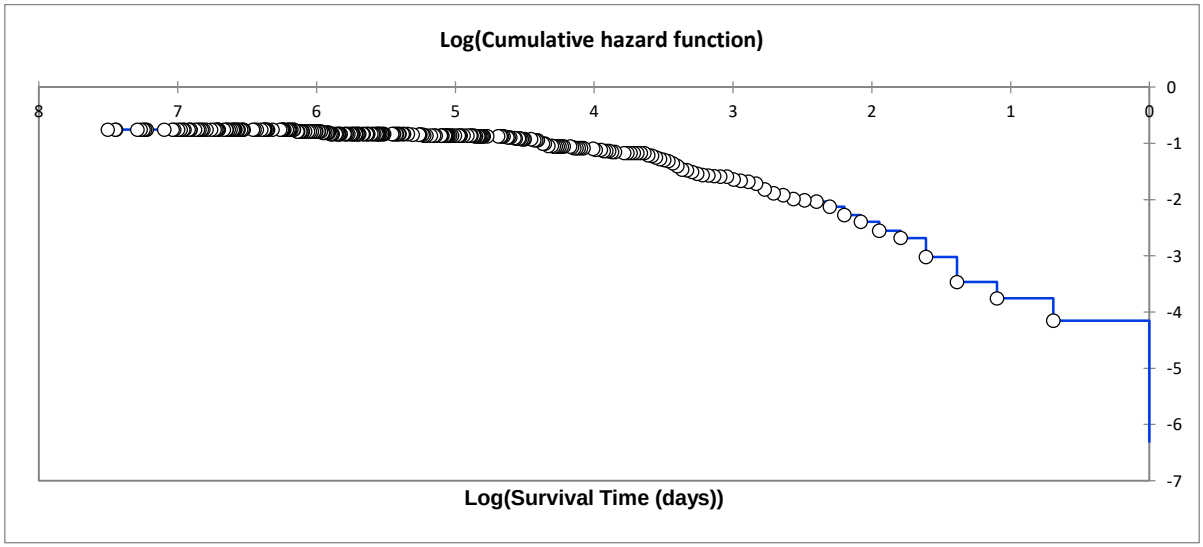
observation was equal zero, this is one of the study problem and solved by Modified Weighted Kaplan Meier.

Figure (4.9a): Cumulative hazard function versus survival time



Souce: charted by researcher using XlStat

Figure (4.9b): log cumulative hazard function versus log survival time

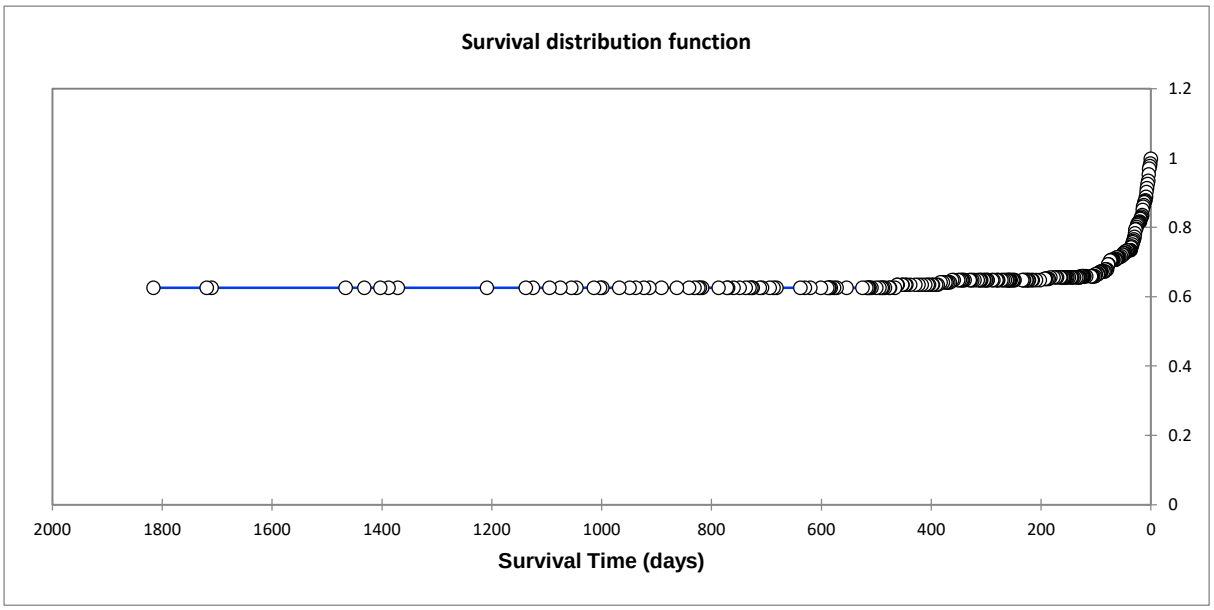


Source: charted by researcher using XlStat

The figures (4.9a &4.9b) are shown some decrease in survival function due to some hazard for the censored children, maybe due to association between risk

factors and occurrence of all, or most diseases have affected children, this found after determined the outcome of children diseases.

Figure (4.10): Survival distribution function



Source: charted by researcher using Stata

Table (4.8): Skewness/Kurtosis tests for Normality

Variable	Obs	Pr(Skewness)	Pr(Kurtosis)	chi2(2)	Sig>chi2
Gender	1,098	0.0001	.	.	.
Age	1,098	0	0	180.33	0
Address	1,098	0	0	91.92	0
Stage	1,097	.	.	.	.
Symptoms	1,098	0	0.2181	229.9	0
Disease type	1,098	0	0.9259	127.92	0
Disease history	1,098	.	.	.	.
Height(cm)	755	0	0.3354	75.3	0
Weight(kg)	1,076	0	0	1293.81	0
No of relapses	1,093	0	0	545.88	0
Status	1,098	0	0.78	212.04	0
Survival time	1,098	0	0	874.94	0

Source: calculated by researcher used Stata

Table (4.8) describe the hypothesis test for data H_0: data follow a normal distribution versus H_1: data do not follow a normal distribution. all variables

shown are signifant (reject H_0), which mean data are not followed the normal distribution.

Table (4.9): Survival rate estimation and 95% C.I by K-M and W-K-M

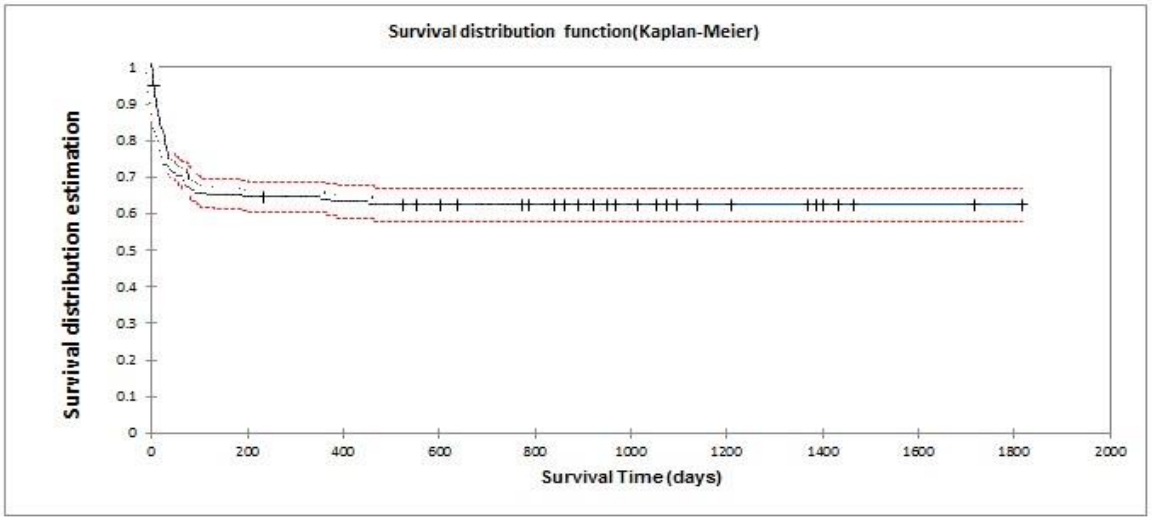
Disease Type	K-M Estimation (SE)	WKM Estimation (SE)	95% CI of K-M	95% CI of WKM
Acute Renal Failure	0.99 (0.0153)	0.98 (0.0077)	0.7576-0.8045	0.1470-0.1515
Congenital Deformity Heart	0.99 (0.0157)	0.98 (0.0077)	0.7469-0.7944	0.1472-0.1518
Leukemia	0.99 (0.0152)	0.98 (0.0077)	0.7619-0.8089	0.1475-0.1521
Septicaemia	0.99 (0.0147)	0.98 (0.0078)	0.7832-0.8290	0.1487-0.1534
Sickle cell disease	0.99 (0.0147)	0.98 (0.0079)	0.7791-0.8257	0.1482-0.1528

Source: calculated by researcher used XLStat

Table (4.9), shows the generalization of Kaplan-Meier method with proper weights causes unbiased estimations of survival probability at any time. As shown in figure (4.13b), at the beginning of the study the rate of censoring is low, and the estimations of both methods are nearly identical, but as time goes by the end of the study and as the censored observations increase, the discrepancy between the estimations of two methods arises, also (Table 4.10) showed that the Weighted K-M estimations had lower standard errors and shorter confidence intervals. Moreover, one of the problems existing in Kaplan-Meier survival curve with the last censored observation is the survival function for observations after that time is indefinable. But the survival curve of Weighted Kaplan-Meier using proper weighing reaches the horizontal axis even if the last observation is censored.

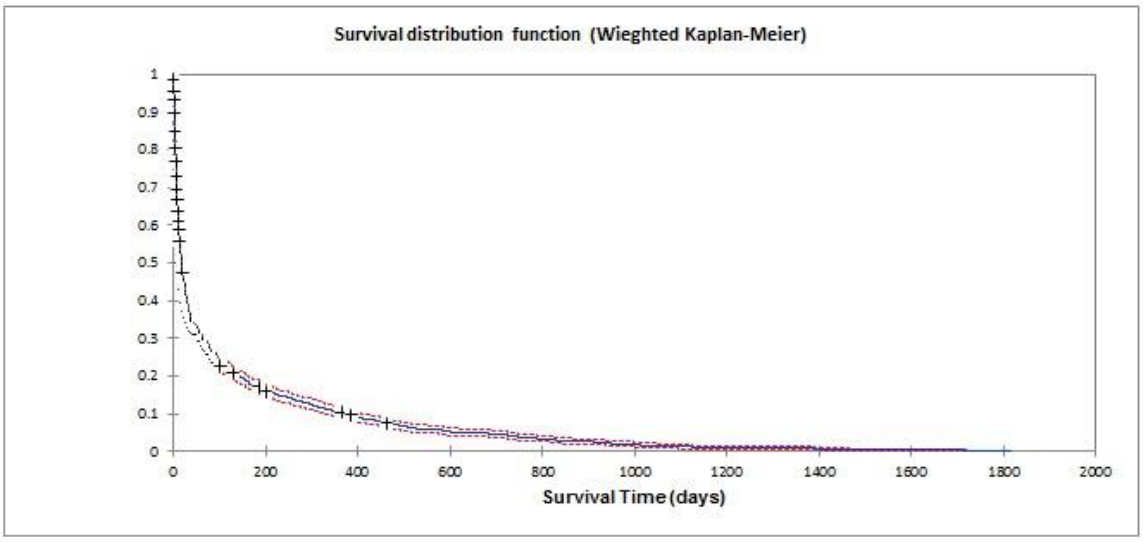
Large amounts of censoring K-M method cause survival probability to be constant at these time-points, whereas the number of subjects at risk decreases markedly. The constancy of survival probabilities leads in overestimation, but WKM using appropriate weights-reduces bias in survival probabilities in censored time-points and resolves the problem of overestimation. Censoring assumption is necessary to estimate survival probabilities; moreover, it is indispensable for common tests in survival analysis. MWKM function is tested for children morbidity and mortality data compared with traditional K-M estimator and WKM stimator. It is found that the K-M estimator gave very high probability of survival (bias). This over estimation is controlled by WKM estimator, but the survival probability estimated by this method was zero for the last censored observation. The survival probabilities given by MWKM estimator was same as given by weighted K-M estimator, but the important point is that MWKM method gave accurate probability of survival time to the last censored observation (0.2167-0.9002), when the survival rate (p_j)=0.1 to 0.9 respectively and 1 if the survival probability to the last censored observation equal "1".

Figure (4.11a): Survival distribution estimation used K-M



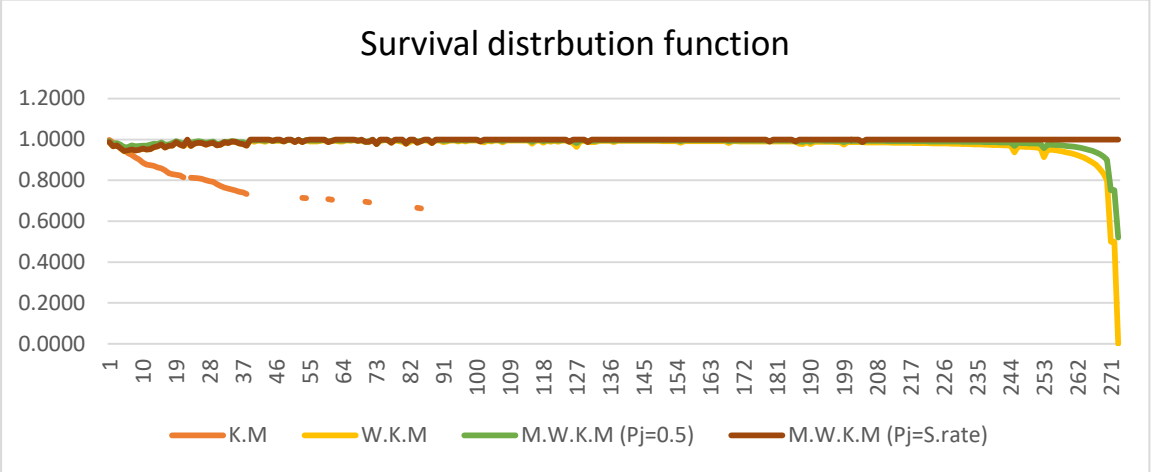
Source: charted by researcher using NCSS

Figure (4.11b): Survival distribution estimation used WKM



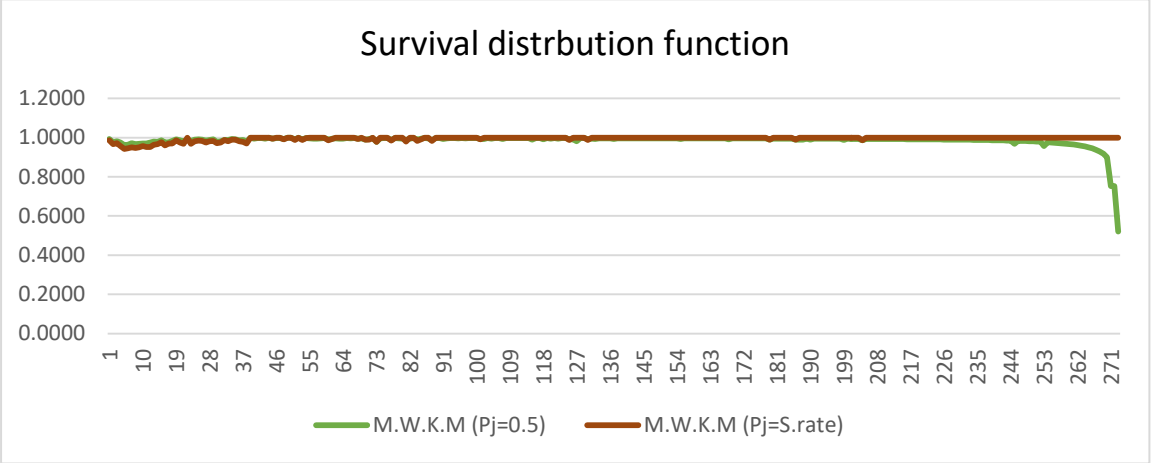
Source: charted by researcher using NCSS

Figure (4.12a): Survival probability used K.M, W.K.M and MWKM



Source: charted by researcher using NCSS

Figure (4.12b): Survival probability for MWKM if $P_j = 0.5$



Source: charted by researcher using Excel

Basic Quantities in Survival Analysis, Let *T* be the positive random variable denoting the time to occurrence of the event of interest. In summarizing the survival data, the two functions namely survival function and the hazard function are of central interest. The survival function usually denoted by *S*(*t*) which estimates the probability that a subject survives greater than or equal to some specified time *t*. Therefore, the survival function is, S(t)=P(T≥t); t>0, if F(t) is the cumulative distribution function of *t*, then F(t)=P(T ≤t) = 1 −S(t). The properties of the survival function are monotonically non-increasing; at time *t* = 0, S(t)=1 and at infinite time t, *S(t)=0*. Then function *S(t)* is also known as the cumulative survival rate. The graph of *S(t)* on time is called the survival curve (Kim et al. 2006). The hazard function at time *t* is

$$h(t) = lim_{\Delta t \to 0} \frac{P(t \le T < t+\Delta t)/T \ge t)}{\Delta t} = \frac{f(t)}{S(t)} \qquad (4.1)$$

The hazard function is also known as instantaneous death rate or the conditional mortality rate. Some characteristics of the hazard function are, *h(t)* may increase, decrease or remain constant or follow any other pattern, $h(t) \ge 0$ and has no upper limit and it is not a probability and depends on time units. The shape of the hazard function *h(t)* population indicates the type of risk to which the under study is exposed as a function of time. The cumulative hazard function is denoted by *h(t)* and is

$H(t)=\int h(x)dx = -\log S(t)$

Table (4.10): Description of censored types and death

Death and censored status	Frequency	Valid Percent
Death	235	21.4
Study end without got event	825	75.1
Withdraw	10	.9
lost to follow-up	28	2.6
Total	1098	100.0

Source: calculated by researcher used SPSS

Table (4.11): Diseases type and affected children details

Disease Type	Total N	N of Events	Censored	
			N	Percent
Acute Renal Failure	100	22	78	78.0%
Congenital Deformity Heart	104	24	80	76.9%
Leukaemia	98	19	79	80.6%
Septicaemia	483	155	328	67.9%
Sickle cell disease	313	15	298	95.2%
Overall	1098	235	863	78.6%

Source: calculated by researcher used SPSS

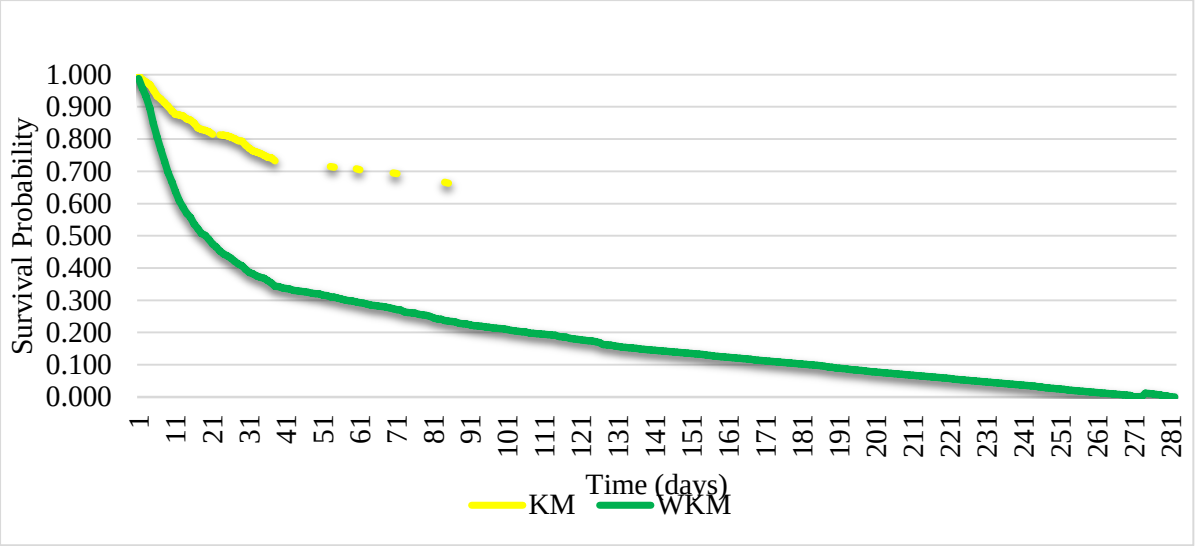
Table (4.12): Diseases type and affected children details per gender

Disease Type	Gender	Total N	N of Events	Censored	
				N	Percent
Acute Renal Failure	Male	49	6	43	87.8%
	Female	51	16	35	68.6%
	Overall	100	22	78	78.0%
Congenital Deformity Heart	Male	60	17	43	71.7%
	Female	44	7	37	84.1%
	Overall	104	24	80	76.9%
Leukaemia	Male	59	10	49	83.1%
	Female	39	9	30	76.9%
	Overall	98	19	79	80.6%
Septicaemia	Male	289	87	202	69.9%
	Female	194	68	126	64.9%
	Overall	483	155	328	67.9%
Sickle cell disease	Male	171	10	161	94.2%
	Female	142	5	137	96.5%
	Overall	313	15	298	95.2%
Overall	Overall	1098	235	863	78.6%

Source: calculated by researcher used SPSS

Table (4.12), explained that the events and censored of median male's number was more than female (finding).

Figure (4.12c): Survival probability used K-M and WKM



Source: charted by researcher using Excel

Methods as figure (4.12b) illustrates, the estimations derived from both methods are approximately close to each other at the beginning of the study where the rate of censoring was low. But as time passes and the rate of censoring increases, Kaplan-Meier estimations always estimate the survival probabilities more than their real amounts whereas Weighted Kaplan-Meier presents more accurate estimations for patients' survival by placing appropriate weights for censored observations.

Table (**4.13)**: Odds Status (case control studies)

Cases	Controls	Odds	95% Conf. Interval	
235	863	0.27231	0.23574	0.31455

Source: calculated by researcher used XlStat

Table (4.14): Median survival time test of enumerating sample-space

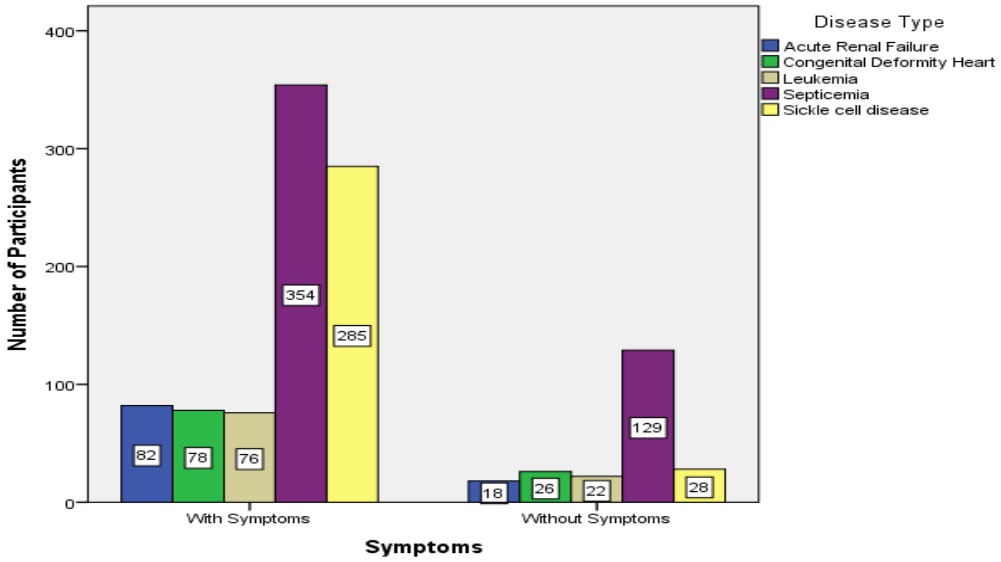
Greater than the median	Disease Type					Total	Pearson chi2(4)	sig	Fisher
	ARF	CDH	Leukemia	Septicaemia	SCD				
No	58	69	29	309	96	561	114.04	0.00	0.00
Yes	42	35	69	174	217	537			
Total	100	104	98	483	313	1,098			

Source: calculated by researcher used Stata

stage 5: enumerations = 1; stage 4: enumerations = 92
stage 3: enumerations = 6983; stage 2: enumerations = 453087
stage 1: enumerations = 0.

Table (4.14) explain the Kruskal-Wallis of survival time for equality-of-populations rank test of diseases and median ties.

Fig (4.13): Distribution of symptom severity in 5 diseases sample



Source: charted by researcher using SPSS

Figure (4.13) show using of an ordinal scale in symptom severity that measured during the start of remission on a 5-point ordinal scale with response options: symptoms got much worse, slightly worse, no change, and the outcome data are distributed as shown in the figure below. slightly improved, or much improved. there was total of n=1098 participants in the trial randomized to an experimental treatment or placebo.

Table (4.15): Declaration of survival data

failure event: status == 1 (scale1) obs. time interval: (0, survival time days] exit on or before: failure	
1098 15	total obs. obs. ends on or before entering ()
1083 233 failure data 115631 at risk from t = 0 earliest observed entry t = 0 last observed exit t = 1816	obs. remaining, representing failures in single record/single total analysis time at risk,

Source: calculated by researcher used Stata

Table (4.16): Median days of survival time for children under Five Yrs.

Category	Total	Per subject			
		Mean	min	median	max
No. of subjects	1083				
No. of records	1083	1	1	1	1
(First) entry time	0	0	0	0	0
(Final) exit time		106.7692	1	16	1816
Subject with gap	0				
Time on gap if gap	0				
Time at risk	115631	106.7692	1	16	1816
Failures	233	0.2151	0	0	1

Source: calculated by researcher used Stata

Table (4.16), shows the median days of survival time for and the category of days of children at risk and death.

Table (4.17a): Exposed status death and unexposed censored

Disease type	IRD	[95% Conf. Interval]	Weight
Acute Renal Failure	.0511	.0450-.0572	411 (tb)
Congenital Deformity Heart	.0166	.0129-.0203	1384 (tb)
Leukaemia	.0229	.0196-.0261	831 (tb)
Septicaemia	.0479	.0434-.0525	3234 (tb)
Sickle cell disease	.0281	.0271-.0293	533 (tb)
Pooled (direct)	.0299	.0256-.0341	
I. Standardized	.0364	.0318-.0411	

Source: calculated by researcher used Stata

Table (4.17b): Exposed gender female and unexposed male

Disease type	*IRR*	*95% conf. interval*		*M-W Weight*
Acute Renal Failure	1.3080	0.4796	4.1148	3.9391 (exact)
Congenital Deformity Heart	0.6236	0.2170	1.6022	6.5967 (exact)
Leukemia	2.4405	0.8775	6.6829	2.6942 (exact)
Septicaemia	1.0746	0.7707	1.4929	36.634 (exact)
Sickle cell disease	0.5689	0.1526	1.8268	4.6776 (exact)
Crude	0.9717	0.7432	1.2677	
M-H combined	1.0610	0.8181	1.3761	

Survival distribution function test of homogeneity(M-H) and chi2 (4)=6.15 with pr>chi2 = 0.1882

Table (4.17c): Exposed disease with and without symptoms

Disease type	*IRR*	*95% conf. interval*		*M-W Weight*
Acute Renal Failure	24.5902	9.2875	71.9889	0.5265 (exact)
Congenital Deformity Heart	6.3079	2.2571	21.7734	1.8167 (exact)
Leukemia	-	4022115	-	0 (exact)
Septicaemia	15.6846	10.6021	23.7954	6.2947 (exact)
Sickle cell disease	-	127.389	-	0 (exact)
Crude	55.2052	39.6935	78.2327	
M-H combined	17.9152	13.1743	24.3621	

Source: calculated by researcher used Stata

Test of homogeneity (M-H); chi2 (4)=5.19; pr>chi2 = 0.0746. This table explain the symptoms incidence-rate ratio (IRR) within the diseases (linx et al., 2004).

Table (4.18): Children times at risk

Disease Type	time at risk	incidence rate	no. of subjects	Survival time		
				25%	50%	75%
Acute Renal Failure	5677	0.003699	97	30	.	.
Congenital Heart D	5986	0.003842	102	37	202	.
Leukemia	9205	0.002064	98	102	.	.
Septicaemia	12126	0.012783	477	16	32	365
Sickle Cell Disease	82637	0.000182	309	.	.	.
Total	115631	0.002015	1083	35	.	.

Source: calculated by researcher used Stata

Table (4.18) presents summary statistics: time at risk; incidence rate; number of subjects; and the 25th, 50th, and 75th percentiles of survival time and can be used with single or multiple record or single or multiple failure survival time data.

Table (4.19): Number of events per disease

Stratum	Total observed	Total failed	Total censored	Time steps (day)
Acute Renal Failure	100	22	78	51
Congenital Heart D.	104	24	80	48
Leukemia	98	19	79	68
Septicaemia	483	155	328	74
Sickle Cell Disease	313	15	298	192

Source: calculated by researcher used Stata

Table (4.20a): Summary statistics of Acute Renal Failure (ARF)

Total observed	Total failed	Total censored
100	22	78

Table (4.20a) and the similar below tables are shown the total of children died and censored for the respective disease.

Table (4.20b): Survival probability estimation of WKM vs. MWKM for ARF

Survival Time (days)	At risk	Failed	Censored	Proportion failed	Survival rate (p_j)	Survival distribution function (K-M)	WKM	MWKM (p_j=survival rate)
0	100	1	2	0.010	0.990	0.9900	0.9702	0.9704
1	97	2	1	0.021	0.979	0.9794	0.9693	0.9696
2	94	0	3			1.0000	0.9681	1.0000
3	91	0	5			1.0000	0.9451	1.0000
4	86	1	5	0.012	0.988	0.9884	0.9309	0.9333
5	80	1	4	0.013	0.988	0.9875	0.9381	0.9408
6	75	0	6			1.0000	0.9200	1.0000
7	69	1	2	0.014	0.986	0.9855	0.9569	0.9589
8	66	3	1	0.045	0.955	0.9545	0.9401	0.9417
9	62	0	1			1.0000	0.9839	1.0000
10	61	1	6	0.016	0.984	0.9836	0.8869	0.8990
11	54	0	3			1.0000	0.9444	1.0000
12	51	0	4			1.0000	0.9216	1.0000
13	47	1	1	0.021	0.979	0.9787	0.9579	0.9609
14	45	3	0	0.067	0.933	0.9333	0.9333	0.9333
17	42	1	0	0.024	0.976	0.9762	0.9762	0.9762
18	41	0	1			1.0000	0.9756	1.0000
19	40	0	1			1.0000	0.9750	1.0000
22	39	0	2			1.0000	0.9487	1.0000
25	37	0	2			1.0000	0.9459	1.0000
26	35	0	1			1.0000	0.9714	1.0000
27	34	1	0	0.029	0.971	0.9706	0.9706	0.9706
29	33	0	2			1.0000	0.9394	1.0000
30	31	1	0	0.032	0.968	0.9677	0.9677	0.9677
31	30	1	1	0.033	0.967	0.9667	0.9344	0.9438
33	28	0	1			1.0000	0.9643	1.0000
35	27	1	0	0.037	0.963	0.9630	0.9630	0.9630
36	26	0	1			1.0000	0.9615	1.0000
37	25	1	0	0.040	0.960	0.9600	0.9600	0.9600
42	24	0	1			1.0000	0.9583	1.0000
45	23	0	1			1.0000	0.9565	1.0000
48	22	1	0	0.045	0.955	0.9545	0.9545	0.9545
51	21	0	1			1.0000	0.9524	1.0000
54	20	0	1			1.0000	0.9500	1.0000
60	19	0	1			1.0000	0.9474	1.0000
62	18	0	1			1.0000	0.9444	1.0000
72	17	0	1			1.0000	0.9412	1.0000
79	16	1	0	0.063	0.938	0.9375	0.9375	0.9375

92	15	0	2			1.0000	0.8667	1.0000
107	13	0	2			1.0000	0.8462	1.0000
124	11	0	1			1.0000	0.9091	1.0000
125	10	0	1			1.0000	0.9000	1.0000
126	9	0	1			1.0000	0.8889	1.0000
160	8	0	1			1.0000	0.8750	1.0000
192	7	0	1			1.0000	0.8571	1.0000
31	30	1	1	0.033	0.967	0.9667	0.9344	0.9438
33	28	0	1			1.0000	0.9643	1.0000
35	27	1	0	0.037	0.963	0.9630	0.9630	0.9630
36	26	0	1			1.0000	0.9615	1.0000
37	25	1	0	0.040	0.960	0.9600	0.9600	0.9600
42	24	0	1			1.0000	0.9583	1.0000
297	6	0	1			1.0000	0.8333	1.0000
300	5	0	1			1.0000	0.8000	1.0000
304	4	0	1			1.0000	0.7500	1.0000
379	3	0	1			1.0000	0.6667	1.0000
831	2	0	1			1.0000	0.5000	1.0000
1046	1	0	1			1.0000	0.0000	1.0000

Table (4.20b) and the similar below tables are shown the survival days of children and their probability to survive (p_j) and the number of children at risk then how many children didn't recovery from disease and passed away with their proportion. The number of children has been censored till the end of study. Then compare the survive of children for the three methods K-M, WKM and MWKM.

Table (4.20c): Survival probability estimation by MWKM in ARF

MWKM (if value of p_j=0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9)								
0.9880	0.9860	0.9841	0.9821	0.9801	0.9781	0.9761	0.9742	0.9722
0.9784	0.9774	0.9764	0.9753	0.9743	0.9733	0.9723	0.9713	0.9703
0.9968	0.9936	0.9904	0.9872	0.9840	0.9809	0.9777	0.9745	0.9713
0.9945	0.9890	0.9835	0.9780	0.9725	0.9670	0.9615	0.9561	0.9506

0.9826	0.9769	0.9711	0.9654	0.9596	0.9539	0.9482	0.9424	0.9367
0.9826	0.9776	0.9727	0.9678	0.9628	0.9579	0.9529	0.9480	0.9431
0.9920	0.9840	0.9760	0.9680	0.9600	0.9520	0.9440	0.9360	0.9281
0.9827	0.9798	0.9769	0.9741	0.9712	0.9684	0.9655	0.9627	0.9598
0.9531	0.9517	0.9502	0.9488	0.9473	0.9459	0.9444	0.9430	0.9415
0.9984	0.9968	0.9952	0.9935	0.9919	0.9903	0.9887	0.9871	0.9855
0.9739	0.9643	0.9546	0.9449	0.9353	0.9256	0.9159	0.9063	0.8966
0.9944	0.9889	0.9833	0.9778	0.9722	0.9667	0.9611	0.9556	0.9500
0.9922	0.9843	0.9765	0.9686	0.9608	0.9530	0.9451	0.9373	0.9295
0.9766	0.9746	0.9725	0.9704	0.9683	0.9662	0.9641	0.9621	0.9600
0.9333	0.9333	0.9333	0.9333	0.9333	0.9333	0.9333	0.9333	0.9333
0.9762	0.9762	0.9762	0.9762	0.9762	0.9762	0.9762	0.9762	0.9762
0.9976	0.9951	0.9927	0.9902	0.9878	0.9854	0.9829	0.9805	0.9781
0.9975	0.9950	0.9925	0.9900	0.9875	0.9850	0.9825	0.9800	0.9775
0.9949	0.9897	0.9846	0.9795	0.9744	0.9692	0.9641	0.9590	0.9539
0.9946	0.9892	0.9838	0.9784	0.9730	0.9676	0.9622	0.9568	0.9514
0.9971	0.9943	0.9914	0.9886	0.9857	0.9829	0.9800	0.9771	0.9743
0.9706	0.9706	0.9706	0.9706	0.9706	0.9706	0.9706	0.9706	0.9706
0.9939	0.9879	0.9818	0.9758	0.9697	0.9636	0.9576	0.9515	0.9455
0.9677	0.9677	0.9677	0.9677	0.9677	0.9677	0.9677	0.9677	0.9677
0.9634	0.9602	0.9570	0.9538	0.9506	0.9473	0.9441	0.9409	0.9377
0.9964	0.9929	0.9893	0.9857	0.9821	0.9786	0.9750	0.9714	0.9679
0.9630	0.9630	0.9630	0.9630	0.9630	0.9630	0.9630	0.9630	0.9630
0.9962	0.9923	0.9885	0.9846	0.9808	0.9769	0.9731	0.9692	0.9654
0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
0.9958	0.9917	0.9875	0.9833	0.9792	0.9750	0.9708	0.9667	0.9625
0.9957	0.9913	0.9870	0.9826	0.9783	0.9739	0.9696	0.9652	0.9609
0.9545	0.9545	0.9545	0.9545	0.9545	0.9545	0.9545	0.9545	0.9545
0.9952	0.9905	0.9857	0.9810	0.9762	0.9714	0.9667	0.9619	0.9572
0.9950	0.9900	0.9850	0.9800	0.9750	0.9700	0.9650	0.9600	0.9550
0.9867	0.9733	0.9600	0.9467	0.9334	0.9201	0.9068	0.8935	0.8803
0.9846	0.9692	0.9539	0.9385	0.9232	0.9078	0.8925	0.8772	0.8620
0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9900	0.9800	0.9700	0.9600	0.9500	0.9400	0.9301	0.9201	0.9101
0.9889	0.9778	0.9667	0.9556	0.9445	0.9334	0.9223	0.9112	0.9002
0.9875	0.9750	0.9625	0.9500	0.9375	0.9251	0.9126	0.9002	0.8877
0.9857	0.9714	0.9572	0.9429	0.9286	0.9144	0.9002	0.8860	0.8718
0.9833	0.9667	0.9500	0.9334	0.9168	0.9002	0.8836	0.8671	0.8506
0.9800	0.9600	0.9400	0.9201	0.9002	0.8803	0.8605	0.8407	0.8210

0.9750	0.9500	0.9251	0.9002	0.8753	0.8506	0.8259	0.8013	0.7769
0.9667	0.9334	0.9002	0.8671	0.8341	0.8013	0.7688	0.7365	0.7045
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9002	0.8013	0.7045	0.6106	0.5206	0.4354	0.3558	0.2826	0.2167

Source: calculated by researcher used Stata

Table (4.20c) and the similar below tables are shown the MWKM for 5 groups of children has estimated the probability of survival over time for the last censored Child was (1.00) for each group, while when MWKM probability for the survival estimation to the last censored child for diseases group in range of 0.2167 to 0.9002 according to the survival rate (p_j) value. If p_j=0.1, S^{**}=0.9002 and if p_j=0.9, S^{**}=0.2167.

Table (4.21a): Summary statistics of Congenital Deformity Heart (CDH)

Total observed	Total failed	Total censored
104	24	80

Table (4.21b): Survival probability estimation of W.K.M vs. MWKM for CDH

Survival Time (days)	At risk	Failed	Censored	Proportion failed	Survival rate (p_j)	Survival distribution function (K-M)	WKM	MWKM
0	104	1	1	0.010	0.990	0.9904	0.9809	0.9810
1	102	1	4	0.010	0.990	0.9902	0.9514	0.9521
2	97	1	5	0.010	0.990	0.9897	0.9387	0.9402
3	91	1	3	0.011	0.989	0.9890	0.9564	0.9577
4	87	1	7	0.011	0.989	0.9885	0.9090	0.9131
5	79	1	8	0.013	0.987	0.9873	0.8874	0.8938
6	70	0	8			1.0000	0.8857	1.0000
7	62	1	6	0.016	0.984	0.9839	0.8887	0.8962
8	55	0	5			1.0000	0.9091	1.0000
9	50	0	2			1.0000	0.9600	1.0000
10	48	0	2			1.0000	0.9583	1.0000
11	46	0	4			1.0000	0.9130	1.0000
12	42	1	0	0.024	0.976	0.9762	0.9762	0.9762
13	41	1	1	0.024	0.976	0.9756	0.9518	0.9547
14	39	0	1			1.0000	0.9744	1.0000
15	38	3	0	0.079	0.921	0.9211	0.9211	0.9211
19	35	1	1	0.029	0.971	0.9714	0.9437	0.9496
23	33	0	1			1.0000	0.9697	1.0000

24	32	1	0	0.031	0.969	0.9688	0.9688	0.9688
28	31	0	1			1.0000	0.9677	1.0000
37	30	2	1	0.067	0.933	0.9333	0.9022	0.9112
44	27	1	0	0.037	0.963	0.9630	0.9630	0.9630
45	26	0	1			1.0000	0.9615	1.0000
51	25	1	0	0.040	0.960	0.9600	0.9600	0.9600
57	24	0	1			1.0000	0.9583	1.0000
63	23	1	0	0.043	0.957	0.9565	0.9565	0.9565
64	22	1	0	0.045	0.955	0.9545	0.9545	0.9545
65	21	0	1			1.0000	0.9524	1.0000
68	20	0	1			1.0000	0.9500	1.0000
69	19	0	1			1.0000	0.9474	1.0000
78	18	0	1			1.0000	0.9444	1.0000
80	17	0	1			1.0000	0.9412	1.0000
84	16	0	1			1.0000	0.9375	1.0000
96	15	0	1			1.0000	0.9333	1.0000
102	14	1	0	0.071	0.929	0.9286	0.9286	0.9286
133	13	0	1			1.0000	0.9231	1.0000
152	12	0	1			1.0000	0.9167	1.0000
183	11	0	1			1.0000	0.9091	1.0000
186	10	1	0	0.100	0.900	0.9000	0.9000	0.9000
202	9	1	0	0.111	0.889	0.8889	0.8889	0.8889
342	8	0	1			1.0000	0.8750	1.0000
348	7	0	1			1.0000	0.8571	1.0000
359	6	0	1			1.0000	0.8333	1.0000
374	5	0	1			1.0000	0.8000	1.0000
417	4	0	1			1.0000	0.7500	1.0000
463	3	1	0	0.333	0.667	0.6667	0.6667	0.6667
484	2	0	1			1.0000	0.5000	1.0000
731	1	0	1			1.0000	0.0000	1.0000

Table (4.21c): Survival probability estimation of MWKM for CDH

MWKM (if value of p_j=0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9)								
0.9894	0.9885	0.9875	0.9866	0.9856	0.9847	0.9837	0.9828	0.9818
0.9863	0.9824	0.9785	0.9747	0.9708	0.9669	0.9630	0.9591	0.9553
0.9846	0.9795	0.9744	0.9693	0.9642	0.9591	0.9540	0.9489	0.9438
0.9858	0.9825	0.9792	0.9760	0.9727	0.9694	0.9662	0.9629	0.9597
0.9806	0.9726	0.9646	0.9567	0.9487	0.9408	0.9329	0.9249	0.9170
0.9773	0.9673	0.9574	0.9474	0.9374	0.9274	0.9174	0.9074	0.8975
0.9886	0.9771	0.9657	0.9543	0.9429	0.9315	0.9201	0.9087	0.8973
0.9743	0.9648	0.9553	0.9458	0.9363	0.9268	0.9173	0.9078	0.8983
0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9960	0.9920	0.9880	0.9840	0.9800	0.9760	0.9720	0.9680	0.9640
0.9958	0.9917	0.9875	0.9833	0.9792	0.9750	0.9708	0.9667	0.9625
0.9913	0.9826	0.9739	0.9652	0.9565	0.9478	0.9392	0.9305	0.9218
0.9762	0.9762	0.9762	0.9762	0.9762	0.9762	0.9762	0.9762	0.9762
0.9732	0.9709	0.9685	0.9661	0.9637	0.9613	0.9590	0.9566	0.9542
0.9974	0.9949	0.9923	0.9897	0.9872	0.9846	0.9821	0.9795	0.9769
0.9211	0.9211	0.9211	0.9211	0.9211	0.9211	0.9211	0.9211	0.9211
0.9687	0.9659	0.9631	0.9603	0.9576	0.9548	0.9520	0.9492	0.9465
0.9970	0.9939	0.9909	0.9879	0.9848	0.9818	0.9788	0.9758	0.9727
0.9688	0.9688	0.9688	0.9688	0.9688	0.9688	0.9688	0.9688	0.9688
0.9968	0.9935	0.9903	0.9871	0.9839	0.9806	0.9774	0.9742	0.9710
0.9302	0.9271	0.9240	0.9209	0.9178	0.9147	0.9116	0.9084	0.9053
0.9630	0.9630	0.9630	0.9630	0.9630	0.9630	0.9630	0.9630	0.9630
0.9962	0.9923	0.9885	0.9846	0.9808	0.9769	0.9731	0.9692	0.9654
0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600	0.9600
0.9958	0.9917	0.9875	0.9833	0.9792	0.9750	0.9708	0.9667	0.9625
0.9565	0.9565	0.9565	0.9565	0.9565	0.9565	0.9565	0.9565	0.9565
0.9545	0.9545	0.9545	0.9545	0.9545	0.9545	0.9545	0.9545	0.9545
0.9952	0.9905	0.9857	0.9810	0.9762	0.9714	0.9667	0.9619	0.9572
0.9950	0.9900	0.9850	0.9800	0.9750	0.9700	0.9650	0.9600	0.9550
0.9947	0.9895	0.9842	0.9789	0.9737	0.9684	0.9632	0.9579	0.9526
0.9944	0.9889	0.9833	0.9778	0.9722	0.9667	0.9611	0.9556	0.9500
0.9941	0.9882	0.9824	0.9765	0.9706	0.9647	0.9588	0.9530	0.9471
0.9938	0.9875	0.9813	0.9750	0.9688	0.9625	0.9563	0.9500	0.9438
0.9933	0.9867	0.9800	0.9733	0.9667	0.9600	0.9534	0.9467	0.9400
0.9286	0.9286	0.9286	0.9286	0.9286	0.9286	0.9286	0.9286	0.9286
0.9923	0.9846	0.9769	0.9692	0.9615	0.9539	0.9462	0.9385	0.9308

0.9917	0.9833	0.9750	0.9667	0.9583	0.9500	0.9417	0.9334	0.9251
0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000	0.9000
0.8889	0.8889	0.8889	0.8889	0.8889	0.8889	0.8889	0.8889	0.8889
0.9875	0.9750	0.9625	0.9500	0.9375	0.9251	0.9126	0.9002	0.8877
0.9857	0.9714	0.9572	0.9429	0.9286	0.9144	0.9002	0.8860	0.8718
0.9833	0.9667	0.9500	0.9334	0.9168	0.9002	0.8836	0.8671	0.8506
0.9800	0.9600	0.9400	0.9201	0.9002	0.8803	0.8605	0.8407	0.8210
0.9750	0.9500	0.9251	0.9002	0.8753	0.8506	0.8259	0.8013	0.7769
0.6667	0.6667	0.6667	0.6667	0.6667	0.6667	0.6667	0.6667	0.6667
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9002	0.8013	0.7045	0.6106	0.5206	0.4354	0.3558	0.2826	0.2167

Source: calculated by researcher used Stata

Table (4.22a): Summary statistics of Leukemia

Total observed	Total failed	Total censored
98	19	79

Table (4.22b): Survival probability estimation of W.K.M vs. MWKM for Leukemia

Survival Time (days)	At risk	Failed	Censored	Proportion failed	Survival rate (p_j)	Survival distribution function (K.M)	WKM	MWKM
1	98	1	3	0.010	0.990	0.9898	0.9595	0.9598
2	94	0	1			1.0000	0.9894	1.0000
3	93	1	4	0.011	0.989	0.9892	0.9467	0.9476
4	88	1	1	0.011	0.989	0.9886	0.9774	0.9778
5	86	0	2			1.0000	0.9767	1.0000
6	84	1	0	0.012	0.988	0.9881	0.9881	0.9881
7	83	3	1	0.036	0.964	0.9639	0.9522	0.9531
8	79	0	4			1.0000	0.9494	1.0000
9	75	0	2			1.0000	0.9733	1.0000
10	73	0	2			1.0000	0.9726	1.0000
13	71	1	0	0.014	0.986	0.9859	0.9859	0.9859
16	70	0	1			1.0000	0.9857	1.0000
18	69	0	1			1.0000	0.9855	1.0000
19	68	0	1			1.0000	0.9853	1.0000

20	67	0	1			1.0000	0.9851	1.0000
21	66	0	1			1.0000	0.9848	1.0000
28	65	0	1			1.0000	0.9846	1.0000
30	64	1	0	0.016	0.984	0.9844	0.9844	0.9844
35	63	1	0	0.016	0.984	0.9841	0.9841	0.9841
37	62	0	3			1.0000	0.9516	1.0000
39	59	0	1			1.0000	0.9831	1.0000
43	58	0	1			1.0000	0.9828	1.0000
44	57	1	0	0.018	0.982	0.9825	0.9825	0.9825
48	56	0	1			1.0000	0.9821	1.0000
51	55	1	0	0.018	0.982	0.9818	0.9818	0.9818
52	54	0	1			1.0000	0.9815	1.0000
63	53	1	1	0.019	0.981	0.9811	0.9626	0.9657
65	51	0	1			1.0000	0.9804	1.0000
68	50	0	1			1.0000	0.9800	1.0000
69	49	0	2			1.0000	0.9592	1.0000
70	47	0	1			1.0000	0.9787	1.0000
76	46	1	0	0.022	0.978	0.9783	0.9783	0.9783
77	45	1	0	0.022	0.978	0.9778	0.9778	0.9778
79	44	1	0	0.023	0.977	0.9773	0.9773	0.9773
80	43	0	1			1.0000	0.9767	1.0000
91	42	0	1			1.0000	0.9762	1.0000
96	41	0	1			1.0000	0.9756	1.0000
97	40	1	0	0.025	0.975	0.9750	0.9750	0.9750
100	39	0	1			1.0000	0.9744	1.0000
101	38	0	1			1.0000	0.9737	1.0000
102	37	1	2	0.027	0.973	0.9730	0.9204	0.9341
107	34	0	1			1.0000	0.9706	1.0000
122	33	0	1			1.0000	0.9697	1.0000
128	32	0	1			1.0000	0.9688	1.0000
129	31	1	1	0.032	0.968	0.9677	0.9365	0.9454
130	29	0	1			1.0000	0.9655	1.0000
136	28	0	1			1.0000	0.9643	1.0000
143	27	0	2			1.0000	0.9259	1.0000
144	25	0	1			1.0000	0.9600	1.0000
149	24	0	1			1.0000	0.9583	1.0000
156	23	0	1			1.0000	0.9565	1.0000
163	22	0	1			1.0000	0.9545	1.0000
165	21	0	1			1.0000	0.9524	1.0000

188	20	0	1			1.0000	0.9500	1.0000
191	19	0	5			1.0000	0.7368	1.0000
202	14	0	1			1.0000	0.9286	1.0000
209	13	0	1			1.0000	0.9231	1.0000
217	12	0	1			1.0000	0.9167	1.0000
222	11	0	1			1.0000	0.9091	1.0000
231	10	0	1			1.0000	0.9000	1.0000
257	9	0	1			1.0000	0.8889	1.0000
261	8	0	1			1.0000	0.8750	1.0000
272	7	0	1			1.0000	0.8571	1.0000
281	6	0	2			1.0000	0.6667	1.0000
289	4	0	1			1.0000	0.7500	1.0000
303	3	0	1			1.0000	0.6667	1.0000
388	2	0	1			1.0000	0.5000	1.0000
404	1	0	1			1.0000	0.0000	1.0000

Table (4.22c): Survival probability estimation by MWKM in Leukemia

MWKM (if value of p_j=0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9)								
0.9868	0.9837	0.9807	0.9777	0.9746	0.9716	0.9686	0.9656	0.9625
0.9989	0.9979	0.9968	0.9957	0.9947	0.9936	0.9926	0.9915	0.9904
0.9850	0.9807	0.9765	0.9722	0.9680	0.9637	0.9595	0.9552	0.9510
0.9875	0.9864	0.9853	0.9841	0.9830	0.9819	0.9808	0.9796	0.9785
0.9977	0.9953	0.9930	0.9907	0.9884	0.9860	0.9837	0.9814	0.9791
0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881	0.9881
0.9627	0.9615	0.9604	0.9592	0.9580	0.9569	0.9557	0.9546	0.9534
0.9949	0.9899	0.9848	0.9797	0.9747	0.9696	0.9646	0.9595	0.9544
0.9973	0.9947	0.9920	0.9893	0.9867	0.9840	0.9813	0.9787	0.9760
0.9973	0.9945	0.9918	0.9890	0.9863	0.9836	0.9808	0.9781	0.9753
0.9859	0.9859	0.9859	0.9859	0.9859	0.9859	0.9859	0.9859	0.9859
0.9986	0.9971	0.9957	0.9943	0.9929	0.9914	0.9900	0.9886	0.9871
0.9986	0.9971	0.9957	0.9942	0.9928	0.9913	0.9899	0.9884	0.9870
0.9985	0.9971	0.9956	0.9941	0.9926	0.9912	0.9897	0.9882	0.9868
0.9985	0.9970	0.9955	0.9940	0.9925	0.9910	0.9896	0.9881	0.9866
0.9985	0.9970	0.9955	0.9939	0.9924	0.9909	0.9894	0.9879	0.9864
0.9985	0.9969	0.9954	0.9938	0.9923	0.9908	0.9892	0.9877	0.9862
0.9844	0.9844	0.9844	0.9844	0.9844	0.9844	0.9844	0.9844	0.9844
0.9841	0.9841	0.9841	0.9841	0.9841	0.9841	0.9841	0.9841	0.9841

0.9952	0.9903	0.9855	0.9806	0.9758	0.9710	0.9661	0.9613	0.9565
0.9983	0.9966	0.9949	0.9932	0.9915	0.9898	0.9881	0.9864	0.9847
0.9983	0.9966	0.9948	0.9931	0.9914	0.9897	0.9879	0.9862	0.9845
0.9825	0.9825	0.9825	0.9825	0.9825	0.9825	0.9825	0.9825	0.9825
0.9982	0.9964	0.9946	0.9929	0.9911	0.9893	0.9875	0.9857	0.9839
0.9818	0.9818	0.9818	0.9818	0.9818	0.9818	0.9818	0.9818	0.9818
0.9981	0.9963	0.9944	0.9926	0.9907	0.9889	0.9870	0.9852	0.9833
0.9793	0.9774	0.9756	0.9737	0.9719	0.9700	0.9682	0.9663	0.9645
0.9980	0.9961	0.9941	0.9922	0.9902	0.9882	0.9863	0.9843	0.9824
0.9980	0.9960	0.9940	0.9920	0.9900	0.9880	0.9860	0.9840	0.9820
0.9959	0.9918	0.9878	0.9837	0.9796	0.9755	0.9714	0.9674	0.9633
0.9979	0.9957	0.9936	0.9915	0.9894	0.9872	0.9851	0.9830	0.9809
0.9783	0.9783	0.9783	0.9783	0.9783	0.9783	0.9783	0.9783	0.9783
0.9778	0.9778	0.9778	0.9778	0.9778	0.9778	0.9778	0.9778	0.9778
0.9773	0.9773	0.9773	0.9773	0.9773	0.9773	0.9773	0.9773	0.9773
0.9977	0.9953	0.9930	0.9907	0.9884	0.9860	0.9837	0.9814	0.9791
0.9976	0.9952	0.9929	0.9905	0.9881	0.9857	0.9833	0.9810	0.9786
0.9976	0.9951	0.9927	0.9902	0.9878	0.9854	0.9829	0.9805	0.9781
0.9750	0.9750	0.9750	0.9750	0.9750	0.9750	0.9750	0.9750	0.9750
0.9974	0.9949	0.9923	0.9897	0.9872	0.9846	0.9821	0.9795	0.9769
0.9974	0.9947	0.9921	0.9895	0.9868	0.9842	0.9816	0.9789	0.9763
0.9677	0.9625	0.9572	0.9519	0.9467	0.9414	0.9362	0.9309	0.9257
0.9971	0.9941	0.9912	0.9882	0.9853	0.9824	0.9794	0.9765	0.9735
0.9970	0.9939	0.9909	0.9879	0.9848	0.9818	0.9788	0.9758	0.9727
0.9969	0.9938	0.9906	0.9875	0.9844	0.9813	0.9781	0.9750	0.9719
0.9646	0.9615	0.9584	0.9553	0.9521	0.9490	0.9459	0.9428	0.9397
0.9966	0.9931	0.9897	0.9862	0.9828	0.9793	0.9759	0.9724	0.9690
0.9964	0.9929	0.9893	0.9857	0.9821	0.9786	0.9750	0.9714	0.9679
0.9926	0.9852	0.9778	0.9704	0.9630	0.9556	0.9482	0.9408	0.9334
0.9960	0.9920	0.9880	0.9840	0.9800	0.9760	0.9720	0.9680	0.9640
0.9958	0.9917	0.9875	0.9833	0.9792	0.9750	0.9708	0.9667	0.9625
0.9957	0.9913	0.9870	0.9826	0.9783	0.9739	0.9696	0.9652	0.9609
0.9955	0.9909	0.9864	0.9818	0.9773	0.9727	0.9682	0.9636	0.9591
0.9952	0.9905	0.9857	0.9810	0.9762	0.9714	0.9667	0.9619	0.9572
0.9950	0.9900	0.9850	0.9800	0.9750	0.9700	0.9650	0.9600	0.9550
0.9737	0.9474	0.9211	0.8949	0.8688	0.8428	0.8168	0.7910	0.7654
0.9929	0.9857	0.9786	0.9714	0.9643	0.9572	0.9500	0.9429	0.9358
0.9923	0.9846	0.9769	0.9692	0.9615	0.9539	0.9462	0.9385	0.9308
0.9917	0.9833	0.9750	0.9667	0.9583	0.9500	0.9417	0.9334	0.9251

0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9900	0.9800	0.9700	0.9600	0.9500	0.9400	0.9301	0.9201	0.9101
0.9889	0.9778	0.9667	0.9556	0.9445	0.9334	0.9223	0.9112	0.9002
0.9875	0.9750	0.9625	0.9500	0.9375	0.9251	0.9126	0.9002	0.8877
0.9857	0.9714	0.9572	0.9429	0.9286	0.9144	0.9002	0.8860	0.8718
0.9667	0.9334	0.9002	0.8671	0.8341	0.8013	0.7688	0.7365	0.7045
0.9750	0.9500	0.9251	0.9002	0.8753	0.8506	0.8259	0.8013	0.7769
0.9667	0.9334	0.9002	0.8671	0.8341	0.8013	0.7688	0.7365	0.7045
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9002	0.8013	0.7045	0.6106	0.5206	0.4354	0.3558	0.2826	0.2167

Source: calculated by researcher used Stata

Table (4.23a): Summary statistics of Septicaemia

Total observed	Total failed	Total censored
483	155	328

Table (4.23b): Survival probability estimation by W.K.M vs. MWKM in Seoticaemia

Survival Time (days)	At risk	Failed	Censored	Proportion failed	Survival rate (p_j)	Survival distribution function (K-M)	WKM	MWKM
0	483	0	6			1.0000	0.9876	1.0000
1	477	11	5	0.023	0.977	0.9769	0.9667	0.9669
2	461	7	5	0.015	0.985	0.9848	0.9741	0.9745
3	449	6	12	0.013	0.987	0.9866	0.9603	0.9616
4	431	9	18	0.021	0.979	0.9791	0.9382	0.9411
5	404	16	13	0.040	0.960	0.9604	0.9295	0.9328
6	375	7	13	0.019	0.981	0.9813	0.9473	0.9515
7	355	5	18	0.014	0.986	0.9859	0.9359	0.9428
8	332	6	14	0.018	0.982	0.9819	0.9405	0.9468
9	312	12	12	0.038	0.962	0.9615	0.9246	0.9314
10	288	7	15	0.024	0.976	0.9757	0.9249	0.9353

11	266	2	17	0.008	0.992	0.9925	0.9291	0.9424
12	247	1	16	0.004	0.996	0.9960	0.9314	0.9452
13	230	3	13	0.013	0.987	0.9870	0.9312	0.9437
14	214	0	9			1.0000	0.9579	1.0000
15	205	3	12	0.015	0.985	0.9854	0.9277	0.9413
16	190	10	6	0.053	0.947	0.9474	0.9175	0.9257
17	174	2	12	0.011	0.989	0.9885	0.9203	0.9397
18	160	2	3	0.013	0.988	0.9875	0.9690	0.9744
19	155	1	7	0.006	0.994	0.9935	0.9487	0.9620
20	147	5	9	0.034	0.966	0.9660	0.9068	0.9259
21	133	0	7			1.0000	0.9474	1.0000
22	126	1	12	0.008	0.992	0.9921	0.8976	0.9285
23	113	1	6	0.009	0.991	0.9912	0.9385	0.9560
24	106	0	6			1.0000	0.9434	1.0000
25	100	2	2	0.020	0.980	0.9800	0.9604	0.9672
26	96	3	6	0.031	0.969	0.9688	0.9082	0.9304
27	87	2	3	0.023	0.977	0.9770	0.9433	0.9562
28	82	1	2	0.012	0.988	0.9878	0.9637	0.9731
29	79	6	3	0.076	0.924	0.9241	0.8890	0.9042
30	70	3	3	0.043	0.957	0.9571	0.9161	0.9350
31	64	3	0	0.047	0.953	0.9531	0.9531	0.9531
32	61	2	3	0.033	0.967	0.9672	0.9196	0.9435
33	56	2	1	0.036	0.964	0.9643	0.9471	0.9560
34	53	0	1			1.0000	0.9811	1.0000
35	52	0	3			1.0000	0.9423	1.0000
36	49	1	6	0.020	0.980	0.9796	0.8596	0.9231
37	42	1	1	0.024	0.976	0.9762	0.9529	0.9655
38	40	0	1			1.0000	0.9750	1.0000
39	39	0	3			1.0000	0.9231	1.0000
40	36	0	1			1.0000	0.9722	1.0000
42	35	0	1			1.0000	0.9714	1.0000
49	34	0	1			1.0000	0.9706	1.0000
51	33	0	1			1.0000	0.9697	1.0000
54	32	2	0	0.063	0.938	0.9375	0.9375	0.9375
55	30	1	0	0.033	0.967	0.9667	0.9667	0.9667
57	29	0	1			1.0000	0.9655	1.0000

60	28	0	1			1.0000	0.9643	1.0000
61	27	0	1			1.0000	0.9630	1.0000
63	26	0	1			1.0000	0.9615	1.0000
64	25	0	1			1.0000	0.9600	1.0000
68	24	0	1			1.0000	0.9583	1.0000
73	23	1	0	0.043	0.957	0.9565	0.9565	0.9565
76	22	2	0	0.091	0.909	0.9091	0.9091	0.9091
79	20	1	0	0.050	0.950	0.9500	0.9500	0.9500
84	19	1	0	0.053	0.947	0.9474	0.9474	0.9474
91	18	0	1			1.0000	0.9444	1.0000
92	17	1	0	0.059	0.941	0.9412	0.9412	0.9412
96	16	1	0	0.063	0.938	0.9375	0.9375	0.9375
105	15	0	1			1.0000	0.9333	1.0000
154	14	0	1			1.0000	0.9286	1.0000
177	13	0	1			1.0000	0.9231	1.0000
188	12	0	1			1.0000	0.9167	1.0000
191	11	0	1			1.0000	0.9091	1.0000
262	10	0	1			1.0000	0.9000	1.0000
279	9	0	1			1.0000	0.8889	1.0000
309	8	0	1			1.0000	0.8750	1.0000
365	7	1	0	0.143	0.857	0.8571	0.8571	0.8571
386	6	1	0	0.167	0.833	0.8333	0.8333	0.8333
397	5	0	1			1.0000	0.8000	1.0000
398	4	0	1			1.0000	0.7500	1.0000
461	3	0	1			1.0000	0.6667	1.0000
466	2	0	1			1.0000	0.5000	1.0000
687	1	0	1			1.0000	0.0000	1.0000

Table (4.23c): Survival probability estimation by MWKM in Septicaemia

MWKM (if value of p_j=0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9)								
0.9988	0.9975	0.9963	0.9950	0.9938	0.9925	0.9913	0.9901	0.9888
0.9759	0.9749	0.9739	0.9728	0.9718	0.9708	0.9698	0.9687	0.9677
0.9837	0.9827	0.9816	0.9805	0.9795	0.9784	0.9773	0.9763	0.9752
0.9840	0.9814	0.9787	0.9761	0.9735	0.9708	0.9682	0.9655	0.9629

0.9750	0.9709	0.9669	0.9628	0.9587	0.9546	0.9505	0.9464	0.9423
0.9573	0.9542	0.9511	0.9480	0.9449	0.9419	0.9388	0.9357	0.9326
0.9779	0.9745	0.9711	0.9677	0.9643	0.9609	0.9575	0.9541	0.9507
0.9809	0.9759	0.9709	0.9659	0.9609	0.9559	0.9509	0.9459	0.9409
0.9778	0.9736	0.9695	0.9654	0.9612	0.9571	0.9529	0.9488	0.9447
0.9578	0.9541	0.9504	0.9467	0.9430	0.9394	0.9357	0.9320	0.9283
0.9706	0.9655	0.9604	0.9554	0.9503	0.9452	0.9401	0.9351	0.9300
0.9861	0.9798	0.9735	0.9671	0.9608	0.9544	0.9481	0.9418	0.9354
0.9895	0.9830	0.9766	0.9701	0.9637	0.9573	0.9508	0.9444	0.9379
0.9814	0.9758	0.9702	0.9646	0.9591	0.9535	0.9479	0.9423	0.9368
0.9958	0.9916	0.9874	0.9832	0.9790	0.9748	0.9706	0.9664	0.9622
0.9796	0.9738	0.9681	0.9623	0.9565	0.9508	0.9450	0.9392	0.9335
0.9444	0.9414	0.9384	0.9354	0.9324	0.9294	0.9264	0.9234	0.9204
0.9817	0.9749	0.9681	0.9612	0.9544	0.9476	0.9408	0.9340	0.9272
0.9856	0.9838	0.9819	0.9801	0.9782	0.9764	0.9745	0.9727	0.9708
0.9891	0.9846	0.9801	0.9756	0.9711	0.9666	0.9621	0.9577	0.9532
0.9601	0.9542	0.9482	0.9423	0.9364	0.9305	0.9246	0.9187	0.9128
0.9947	0.9895	0.9842	0.9789	0.9737	0.9684	0.9632	0.9579	0.9526
0.9826	0.9732	0.9637	0.9543	0.9448	0.9354	0.9260	0.9166	0.9071
0.9859	0.9806	0.9754	0.9701	0.9648	0.9596	0.9543	0.9491	0.9438
0.9943	0.9887	0.9830	0.9774	0.9717	0.9660	0.9604	0.9547	0.9491
0.9780	0.9761	0.9741	0.9722	0.9702	0.9682	0.9663	0.9643	0.9624
0.9627	0.9566	0.9506	0.9445	0.9385	0.9324	0.9264	0.9203	0.9143
0.9736	0.9703	0.9669	0.9635	0.9602	0.9568	0.9534	0.9501	0.9467
0.9854	0.9830	0.9806	0.9782	0.9758	0.9733	0.9709	0.9685	0.9661
0.9205	0.9170	0.9135	0.9100	0.9065	0.9030	0.8995	0.8960	0.8925
0.9530	0.9489	0.9448	0.9407	0.9366	0.9325	0.9284	0.9243	0.9202
0.9531	0.9531	0.9531	0.9531	0.9531	0.9531	0.9531	0.9531	0.9531
0.9625	0.9577	0.9529	0.9482	0.9434	0.9387	0.9339	0.9292	0.9244
0.9626	0.9608	0.9591	0.9574	0.9557	0.9540	0.9522	0.9505	0.9488
0.9981	0.9962	0.9943	0.9925	0.9906	0.9887	0.9868	0.9849	0.9830
0.9942	0.9885	0.9827	0.9769	0.9712	0.9654	0.9596	0.9539	0.9481
0.9676	0.9556	0.9436	0.9316	0.9197	0.9077	0.8957	0.8838	0.8719
0.9739	0.9715	0.9692	0.9669	0.9646	0.9622	0.9599	0.9576	0.9553
0.9975	0.9950	0.9925	0.9900	0.9875	0.9850	0.9825	0.9800	0.9775
0.9923	0.9846	0.9769	0.9692	0.9615	0.9539	0.9462	0.9385	0.9308
0.9972	0.9944	0.9917	0.9889	0.9861	0.9833	0.9806	0.9778	0.9750

0.9971	0.9943	0.9914	0.9886	0.9857	0.9829	0.9800	0.9771	0.9743
0.9971	0.9941	0.9912	0.9882	0.9853	0.9824	0.9794	0.9765	0.9735
0.9970	0.9939	0.9909	0.9879	0.9848	0.9818	0.9788	0.9758	0.9727
0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375
0.9667	0.9667	0.9667	0.9667	0.9667	0.9667	0.9667	0.9667	0.9667
0.9966	0.9931	0.9897	0.9862	0.9828	0.9793	0.9759	0.9724	0.9690
0.9964	0.9929	0.9893	0.9857	0.9821	0.9786	0.9750	0.9714	0.9679
0.9963	0.9926	0.9889	0.9852	0.9815	0.9778	0.9741	0.9704	0.9667
0.9962	0.9923	0.9885	0.9846	0.9808	0.9769	0.9731	0.9692	0.9654
0.9960	0.9920	0.9880	0.9840	0.9800	0.9760	0.9720	0.9680	0.9640
0.9958	0.9917	0.9875	0.9833	0.9792	0.9750	0.9708	0.9667	0.9625
0.9565	0.9565	0.9565	0.9565	0.9565	0.9565	0.9565	0.9565	0.9565
0.9091	0.9091	0.9091	0.9091	0.9091	0.9091	0.9091	0.9091	0.9091
0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500	0.9500
0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474	0.9474
0.9944	0.9889	0.9833	0.9778	0.9722	0.9667	0.9611	0.9556	0.9500
0.9412	0.9412	0.9412	0.9412	0.9412	0.9412	0.9412	0.9412	0.9412
0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375	0.9375
0.9933	0.9867	0.9800	0.9733	0.9667	0.9600	0.9534	0.9467	0.9400
0.9929	0.9857	0.9786	0.9714	0.9643	0.9572	0.9500	0.9429	0.9358
0.9923	0.9846	0.9769	0.9692	0.9615	0.9539	0.9462	0.9385	0.9308
0.9917	0.9833	0.9750	0.9667	0.9583	0.9500	0.9417	0.9334	0.9251
0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9900	0.9800	0.9700	0.9600	0.9500	0.9400	0.9301	0.9201	0.9101
0.9889	0.9778	0.9667	0.9556	0.9445	0.9334	0.9223	0.9112	0.9002
0.9875	0.9750	0.9625	0.9500	0.9375	0.9251	0.9126	0.9002	0.8877
0.8571	0.8571	0.8571	0.8571	0.8571	0.8571	0.8571	0.8571	0.8571
0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333	0.8333
0.9800	0.9600	0.9400	0.9201	0.9002	0.8803	0.8605	0.8407	0.8210
0.9750	0.9500	0.9251	0.9002	0.8753	0.8506	0.8259	0.8013	0.7769
0.9667	0.9334	0.9002	0.8671	0.8341	0.8013	0.7688	0.7365	0.7045
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9002	0.8013	0.7045	0.6106	0.5206	0.4354	0.3558	0.2826	0.2167

Table (4.24a): Summary statistics of Sickle Cell Disease (SCD)

Total observed	Total failed	Total censored
313	15	298

Table (4.24b): Survival probability estimation by W.K.M vs. MWKM in SCD

Survival Time (days)	At risk	Failed	Censored	Proportion failed	Survival rate (p_j)	Survival distribution function (K.M)	WKM	MWKM
0	313	0	4			1.0000	0.9872	1.0000
1	309	0	9			1.0000	0.9709	1.0000
2	300	0	8			1.0000	0.9733	1.0000
3	292	0	12			1.0000	0.9589	1.0000
4	280	5	9	0.018	0.982	0.9821	0.9506	0.9511
5	266	0	6			1.0000	0.9774	1.0000
6	260	0	8			1.0000	0.9692	1.0000
7	252	1	7	0.004	0.996	0.9960	0.9684	0.9690
8	244	0	7			1.0000	0.9713	1.0000
9	237	0	4			1.0000	0.9831	1.0000
10	233	0	2			1.0000	0.9914	1.0000
11	231	0	6			1.0000	0.9740	1.0000
12	225	0	2			1.0000	0.9911	1.0000
14	223	0	1			1.0000	0.9955	1.0000
15	222	0	5			1.0000	0.9775	1.0000
17	217	0	1			1.0000	0.9954	1.0000
19	216	0	1			1.0000	0.9954	1.0000
20	215	0	1			1.0000	0.9953	1.0000
21	214	0	2			1.0000	0.9907	1.0000
23	212	0	1			1.0000	0.9953	1.0000
25	211	0	2			1.0000	0.9905	1.0000
26	209	0	1			1.0000	0.9952	1.0000
27	208	0	2			1.0000	0.9904	1.0000
28	206	0	2			1.0000	0.9903	1.0000
29	204	0	1			1.0000	0.9951	1.0000
30	203	0	2			1.0000	0.9901	1.0000
32	201	0	2			1.0000	0.9900	1.0000
34	199	3	0	0.015	0.985	0.9849	0.9849	0.9849

35	196	1	1	0.005	0.995	0.9949	0.9898	0.9900
37	194	0	2			1.0000	0.9897	1.0000
40	192	0	1			1.0000	0.9948	1.0000
41	191	0	2			1.0000	0.9895	1.0000
42	189	0	2			1.0000	0.9894	1.0000
47	187	0	2			1.0000	0.9893	1.0000
48	185	1	0	0.005	0.995	0.9946	0.9946	0.9946
50	184	0	1			1.0000	0.9946	1.0000
54	183	0	1			1.0000	0.9945	1.0000
57	182	0	1			1.0000	0.9945	1.0000
59	181	0	3			1.0000	0.9834	1.0000
60	178	0	1			1.0000	0.9944	1.0000
61	177	0	1			1.0000	0.9944	1.0000
71	176	0	2			1.0000	0.9886	1.0000
73	174	0	1			1.0000	0.9943	1.0000
74	173	0	2			1.0000	0.9884	1.0000
77	171	0	2			1.0000	0.9883	1.0000
79	169	3	0	0.018	0.982	0.9822	0.9822	0.9822
82	166	0	1			1.0000	0.9940	1.0000
83	165	0	1			1.0000	0.9939	1.0000
84	164	1	1	0.006	0.994	0.9939	0.9878	0.9883
86	162	0	1			1.0000	0.9938	1.0000
90	161	0	2			1.0000	0.9876	1.0000
91	159	0	1			1.0000	0.9937	1.0000
92	158	0	2			1.0000	0.9873	1.0000
93	156	0	3			1.0000	0.9808	1.0000
94	153	0	1			1.0000	0.9935	1.0000
96	152	0	1			1.0000	0.9934	1.0000
97	151	0	1			1.0000	0.9934	1.0000
101	150	0	1			1.0000	0.9933	1.0000
106	149	0	1			1.0000	0.9933	1.0000
109	148	0	2			1.0000	0.9865	1.0000
118	146	0	1			1.0000	0.9932	1.0000
121	145	0	1			1.0000	0.9931	1.0000
122	144	0	1			1.0000	0.9931	1.0000
123	143	0	1			1.0000	0.9930	1.0000
124	142	0	1			1.0000	0.9930	1.0000
130	141	0	2			1.0000	0.9858	1.0000
132	139	0	1			1.0000	0.9928	1.0000

133	138	0	1			1.0000	0.9928	1.0000
140	137	0	1			1.0000	0.9927	1.0000
143	136	0	1			1.0000	0.9926	1.0000
145	135	0	1			1.0000	0.9926	1.0000
157	134	0	1			1.0000	0.9925	1.0000
158	133	0	4			1.0000	0.9699	1.0000
159	129	0	1			1.0000	0.9922	1.0000
163	128	0	2			1.0000	0.9844	1.0000
164	126	0	1			1.0000	0.9921	1.0000
165	125	0	1			1.0000	0.9920	1.0000
171	124	0	1			1.0000	0.9919	1.0000
173	123	0	2			1.0000	0.9837	1.0000
186	121	0	1			1.0000	0.9917	1.0000
188	120	0	1			1.0000	0.9917	1.0000
193	119	0	1			1.0000	0.9916	1.0000
209	118	0	1			1.0000	0.9915	1.0000
215	117	0	2			1.0000	0.9829	1.0000
223	115	0	1			1.0000	0.9913	1.0000
226	114	0	1			1.0000	0.9912	1.0000
227	113	0	2			1.0000	0.9823	1.0000
232	111	0	1			1.0000	0.9910	1.0000
234	110	0	1			1.0000	0.9909	1.0000
248	109	0	1			1.0000	0.9908	1.0000
250	108	0	1			1.0000	0.9907	1.0000
252	107	0	1			1.0000	0.9907	1.0000
255	106	0	1			1.0000	0.9906	1.0000
258	105	0	1			1.0000	0.9905	1.0000
259	104	0	1			1.0000	0.9904	1.0000
266	103	0	1			1.0000	0.9903	1.0000
269	102	0	1			1.0000	0.9902	1.0000
278	101	0	1			1.0000	0.9901	1.0000
287	100	0	1			1.0000	0.9900	1.0000
298	99	0	1			1.0000	0.9899	1.0000
310	98	0	1			1.0000	0.9898	1.0000
312	97	0	1			1.0000	0.9897	1.0000
315	96	0	1			1.0000	0.9896	1.0000
321	95	0	1			1.0000	0.9895	1.0000
325	94	0	2			1.0000	0.9787	1.0000
328	92	0	1			1.0000	0.9891	1.0000

330	91	0	1			1.0000	0.9890	1.0000
339	90	0	1			1.0000	0.9889	1.0000
343	89	0	1			1.0000	0.9888	1.0000
345	88	0	1			1.0000	0.9886	1.0000
351	87	0	1			1.0000	0.9885	1.0000
362	86	0	1			1.0000	0.9884	1.0000
366	85	0	1			1.0000	0.9882	1.0000
369	84	0	1			1.0000	0.9881	1.0000
372	83	0	1			1.0000	0.9880	1.0000
383	82	0	1			1.0000	0.9878	1.0000
388	81	0	1			1.0000	0.9877	1.0000
391	80	0	2			1.0000	0.9750	1.0000
398	78	0	1			1.0000	0.9872	1.0000
406	77	0	1			1.0000	0.9870	1.0000
411	76	0	1			1.0000	0.9868	1.0000
423	75	0	1			1.0000	0.9867	1.0000
429	74	0	1			1.0000	0.9865	1.0000
438	73	0	1			1.0000	0.9863	1.0000
445	72	0	1			1.0000	0.9861	1.0000
447	71	0	2			1.0000	0.9718	1.0000
452	69	0	1			1.0000	0.9855	1.0000
453	68	0	1			1.0000	0.9853	1.0000
462	67	0	1			1.0000	0.9851	1.0000
475	66	0	1			1.0000	0.9848	1.0000
476	65	0	1			1.0000	0.9846	1.0000
488	64	0	1			1.0000	0.9844	1.0000
490	63	0	1			1.0000	0.9841	1.0000
494	62	0	1			1.0000	0.9839	1.0000
500	61	0	1			1.0000	0.9836	1.0000
509	60	0	1			1.0000	0.9833	1.0000
512	59	0	1			1.0000	0.9831	1.0000
514	58	0	1			1.0000	0.9828	1.0000
515	57	0	1			1.0000	0.9825	1.0000
518	56	0	1			1.0000	0.9821	1.0000
525	55	0	1			1.0000	0.9818	1.0000
554	54	0	1			1.0000	0.9815	1.0000
572	53	0	1			1.0000	0.9811	1.0000
577	52	0	1			1.0000	0.9808	1.0000
583	51	0	1			1.0000	0.9804	1.0000

585	50	0	1			1.0000	0.9800	1.0000
586	49	0	1			1.0000	0.9796	1.0000
589	48	0	1			1.0000	0.9792	1.0000
601	47	0	1			1.0000	0.9787	1.0000
620	46	0	1			1.0000	0.9783	1.0000
630	45	0	1			1.0000	0.9778	1.0000
638	44	0	1			1.0000	0.9773	1.0000
682	43	0	1			1.0000	0.9767	1.0000
694	42	0	1			1.0000	0.9762	1.0000
708	41	0	1			1.0000	0.9756	1.0000
712	40	0	1			1.0000	0.9750	1.0000
725	39	0	1			1.0000	0.9744	1.0000
727	38	0	1			1.0000	0.9737	1.0000
738	37	0	1			1.0000	0.9730	1.0000
749	36	0	1			1.0000	0.9722	1.0000
760	35	0	1			1.0000	0.9714	1.0000
770	34	0	1			1.0000	0.9706	1.0000
772	33	0	1			1.0000	0.9697	1.0000
787	32	0	1			1.0000	0.9688	1.0000
817	31	0	1			1.0000	0.9677	1.0000
821	30	0	2			1.0000	0.9333	1.0000
824	28	0	1			1.0000	0.9643	1.0000
841	27	0	1			1.0000	0.9630	1.0000
863	26	0	1			1.0000	0.9615	1.0000
891	25	0	1			1.0000	0.9600	1.0000
913	24	0	1			1.0000	0.9583	1.0000
923	23	0	1			1.0000	0.9565	1.0000
938	22	0	2			1.0000	0.9091	1.0000
949	20	0	1			1.0000	0.9500	1.0000
968	19	0	1			1.0000	0.9474	1.0000
999	18	0	1			1.0000	0.9444	1.0000
1003	17	0	1			1.0000	0.9412	1.0000
1014	16	0	1			1.0000	0.9375	1.0000
1055	15	0	1			1.0000	0.9333	1.0000
1075	14	0	1			1.0000	0.9286	1.0000
1095	13	0	1			1.0000	0.9231	1.0000
1125	12	0	1			1.0000	0.9167	1.0000
1138	11	0	1			1.0000	0.9091	1.0000
1209	10	0	1			1.0000	0.9000	1.0000

1371	9	0	1			1.0000	0.8889	1.0000
1388	8	0	1			1.0000	0.8750	1.0000
1403	7	0	1			1.0000	0.8571	1.0000
1432	6	0	1			1.0000	0.8333	1.0000
1466	5	0	1			1.0000	0.8000	1.0000
1710	4	0	2			1.0000	0.5000	1.0000
1719	2	0	1			1.0000	0.5000	1.0000
1816	1	0	1			1.0000	0.0000	1.0000

Source: calculated by researcher used Stata

Table (4.24c): Survival probability estimation by MWKM in SCD

MWKM (if value of p_j=0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9)								
0.9987	0.9974	0.9962	0.9949	0.9936	0.9923	0.9911	0.9898	0.9885
0.9971	0.9942	0.9913	0.9883	0.9854	0.9825	0.9796	0.9767	0.9738
0.9973	0.9947	0.9920	0.9893	0.9867	0.9840	0.9813	0.9787	0.9760
0.9959	0.9918	0.9877	0.9836	0.9795	0.9753	0.9712	0.9671	0.9630
0.9790	0.9758	0.9727	0.9695	0.9664	0.9632	0.9600	0.9569	0.9537
0.9977	0.9955	0.9932	0.9910	0.9887	0.9865	0.9842	0.9820	0.9797
0.9969	0.9938	0.9908	0.9877	0.9846	0.9815	0.9785	0.9754	0.9723
0.9933	0.9905	0.9877	0.9850	0.9822	0.9794	0.9767	0.9739	0.9711
0.9971	0.9943	0.9914	0.9885	0.9857	0.9828	0.9799	0.9771	0.9742
0.9983	0.9966	0.9949	0.9932	0.9916	0.9899	0.9882	0.9865	0.9848
0.9991	0.9983	0.9974	0.9966	0.9957	0.9948	0.9940	0.9931	0.9923
0.9974	0.9948	0.9922	0.9896	0.9870	0.9844	0.9818	0.9792	0.9766
0.9991	0.9982	0.9973	0.9964	0.9956	0.9947	0.9938	0.9929	0.9920
0.9996	0.9991	0.9987	0.9982	0.9978	0.9973	0.9969	0.9964	0.9960
0.9977	0.9955	0.9932	0.9910	0.9887	0.9865	0.9842	0.9820	0.9797
0.9995	0.9991	0.9986	0.9982	0.9977	0.9972	0.9968	0.9963	0.9959
0.9995	0.9991	0.9986	0.9981	0.9977	0.9972	0.9968	0.9963	0.9958
0.9995	0.9991	0.9986	0.9981	0.9977	0.9972	0.9967	0.9963	0.9958
0.9991	0.9981	0.9972	0.9963	0.9953	0.9944	0.9935	0.9925	0.9916
0.9995	0.9991	0.9986	0.9981	0.9976	0.9972	0.9967	0.9962	0.9958
0.9991	0.9981	0.9972	0.9962	0.9953	0.9943	0.9934	0.9924	0.9915
0.9995	0.9990	0.9986	0.9981	0.9976	0.9971	0.9967	0.9962	0.9957
0.9990	0.9981	0.9971	0.9962	0.9952	0.9942	0.9933	0.9923	0.9913
0.9990	0.9981	0.9971	0.9961	0.9951	0.9942	0.9932	0.9922	0.9913
0.9995	0.9990	0.9985	0.9980	0.9975	0.9971	0.9966	0.9961	0.9956
0.9990	0.9980	0.9970	0.9961	0.9951	0.9941	0.9931	0.9921	0.9911

0.9990	0.9980	0.9970	0.9960	0.9950	0.9940	0.9930	0.9920	0.9910
0.9849	0.9849	0.9849	0.9849	0.9849	0.9849	0.9849	0.9849	0.9849
0.9944	0.9939	0.9934	0.9929	0.9924	0.9919	0.9913	0.9908	0.9903
0.9990	0.9979	0.9969	0.9959	0.9948	0.9938	0.9928	0.9918	0.9907
0.9995	0.9990	0.9984	0.9979	0.9974	0.9969	0.9964	0.9958	0.9953
0.9990	0.9979	0.9969	0.9958	0.9948	0.9937	0.9927	0.9916	0.9906
0.9989	0.9979	0.9968	0.9958	0.9947	0.9937	0.9926	0.9915	0.9905
0.9989	0.9979	0.9968	0.9957	0.9947	0.9936	0.9925	0.9914	0.9904
0.9946	0.9946	0.9946	0.9946	0.9946	0.9946	0.9946	0.9946	0.9946
0.9995	0.9989	0.9984	0.9978	0.9973	0.9967	0.9962	0.9957	0.9951
0.9995	0.9989	0.9984	0.9978	0.9973	0.9967	0.9962	0.9956	0.9951
0.9995	0.9989	0.9984	0.9978	0.9973	0.9967	0.9962	0.9956	0.9951
0.9983	0.9967	0.9950	0.9934	0.9917	0.9901	0.9884	0.9867	0.9851
0.9994	0.9989	0.9983	0.9978	0.9972	0.9966	0.9961	0.9955	0.9949
0.9994	0.9989	0.9983	0.9977	0.9972	0.9966	0.9960	0.9955	0.9949
0.9989	0.9977	0.9966	0.9955	0.9943	0.9932	0.9920	0.9909	0.9898
0.9994	0.9989	0.9983	0.9977	0.9971	0.9966	0.9960	0.9954	0.9948
0.9988	0.9977	0.9965	0.9954	0.9942	0.9931	0.9919	0.9908	0.9896
0.9988	0.9977	0.9965	0.9953	0.9942	0.9930	0.9918	0.9906	0.9895
0.9822	0.9822	0.9822	0.9822	0.9822	0.9822	0.9822	0.9822	0.9822
0.9994	0.9988	0.9982	0.9976	0.9970	0.9964	0.9958	0.9952	0.9946
0.9994	0.9988	0.9982	0.9976	0.9970	0.9964	0.9958	0.9952	0.9945
0.9933	0.9927	0.9921	0.9915	0.9909	0.9903	0.9897	0.9891	0.9884
0.9994	0.9988	0.9981	0.9975	0.9969	0.9963	0.9957	0.9951	0.9944
0.9988	0.9975	0.9963	0.9950	0.9938	0.9925	0.9913	0.9901	0.9888
0.9994	0.9987	0.9981	0.9975	0.9969	0.9962	0.9956	0.9950	0.9943
0.9987	0.9975	0.9962	0.9949	0.9937	0.9924	0.9911	0.9899	0.9886
0.9981	0.9962	0.9942	0.9923	0.9904	0.9885	0.9865	0.9846	0.9827
0.9993	0.9987	0.9980	0.9974	0.9967	0.9961	0.9954	0.9948	0.9941
0.9993	0.9987	0.9980	0.9974	0.9967	0.9961	0.9954	0.9947	0.9941
0.9993	0.9987	0.9980	0.9974	0.9967	0.9960	0.9954	0.9947	0.9940
0.9993	0.9987	0.9980	0.9973	0.9967	0.9960	0.9953	0.9947	0.9940
0.9993	0.9987	0.9980	0.9973	0.9966	0.9960	0.9953	0.9946	0.9940
0.9986	0.9973	0.9959	0.9946	0.9932	0.9919	0.9905	0.9892	0.9878
0.9993	0.9986	0.9979	0.9973	0.9966	0.9959	0.9952	0.9945	0.9938
0.9993	0.9986	0.9979	0.9972	0.9966	0.9959	0.9952	0.9945	0.9938
0.9993	0.9986	0.9979	0.9972	0.9965	0.9958	0.9951	0.9944	0.9938
0.9993	0.9986	0.9979	0.9972	0.9965	0.9958	0.9951	0.9944	0.9937
0.9993	0.9986	0.9979	0.9972	0.9965	0.9958	0.9951	0.9944	0.9937

0.9986	0.9972	0.9957	0.9943	0.9929	0.9915	0.9901	0.9887	0.9872
0.9993	0.9986	0.9978	0.9971	0.9964	0.9957	0.9950	0.9942	0.9935
0.9993	0.9986	0.9978	0.9971	0.9964	0.9957	0.9949	0.9942	0.9935
0.9993	0.9985	0.9978	0.9971	0.9964	0.9956	0.9949	0.9942	0.9934
0.9993	0.9985	0.9978	0.9971	0.9963	0.9956	0.9949	0.9941	0.9934
0.9993	0.9985	0.9978	0.9970	0.9963	0.9956	0.9948	0.9941	0.9933
0.9993	0.9985	0.9978	0.9970	0.9963	0.9955	0.9948	0.9940	0.9933
0.9970	0.9940	0.9910	0.9880	0.9850	0.9820	0.9789	0.9759	0.9729
0.9992	0.9984	0.9977	0.9969	0.9961	0.9953	0.9946	0.9938	0.9930
0.9984	0.9969	0.9953	0.9938	0.9922	0.9906	0.9891	0.9875	0.9859
0.9992	0.9984	0.9976	0.9968	0.9960	0.9952	0.9944	0.9937	0.9929
0.9992	0.9984	0.9976	0.9968	0.9960	0.9952	0.9944	0.9936	0.9928
0.9992	0.9984	0.9976	0.9968	0.9960	0.9952	0.9944	0.9935	0.9927
0.9984	0.9967	0.9951	0.9935	0.9919	0.9902	0.9886	0.9870	0.9854
0.9992	0.9983	0.9975	0.9967	0.9959	0.9950	0.9942	0.9934	0.9926
0.9992	0.9983	0.9975	0.9967	0.9958	0.9950	0.9942	0.9933	0.9925
0.9992	0.9983	0.9975	0.9966	0.9958	0.9950	0.9941	0.9933	0.9924
0.9992	0.9983	0.9975	0.9966	0.9958	0.9949	0.9941	0.9932	0.9924
0.9983	0.9966	0.9949	0.9932	0.9915	0.9897	0.9880	0.9863	0.9846
0.9991	0.9983	0.9974	0.9965	0.9957	0.9948	0.9939	0.9930	0.9922
0.9991	0.9982	0.9974	0.9965	0.9956	0.9947	0.9939	0.9930	0.9921
0.9982	0.9965	0.9947	0.9929	0.9912	0.9894	0.9876	0.9858	0.9841
0.9991	0.9982	0.9973	0.9964	0.9955	0.9946	0.9937	0.9928	0.9919
0.9991	0.9982	0.9973	0.9964	0.9955	0.9945	0.9936	0.9927	0.9918
0.9991	0.9982	0.9972	0.9963	0.9954	0.9945	0.9936	0.9927	0.9917
0.9991	0.9981	0.9972	0.9963	0.9954	0.9944	0.9935	0.9926	0.9917
0.9991	0.9981	0.9972	0.9963	0.9953	0.9944	0.9935	0.9925	0.9916
0.9991	0.9981	0.9972	0.9962	0.9953	0.9943	0.9934	0.9925	0.9915
0.9990	0.9981	0.9971	0.9962	0.9952	0.9943	0.9933	0.9924	0.9914
0.9990	0.9981	0.9971	0.9962	0.9952	0.9942	0.9933	0.9923	0.9913
0.9990	0.9981	0.9971	0.9961	0.9951	0.9942	0.9932	0.9922	0.9913
0.9990	0.9980	0.9971	0.9961	0.9951	0.9941	0.9931	0.9922	0.9912
0.9990	0.9980	0.9970	0.9960	0.9950	0.9941	0.9931	0.9921	0.9911
0.9990	0.9980	0.9970	0.9960	0.9950	0.9940	0.9930	0.9920	0.9910
0.9990	0.9980	0.9970	0.9960	0.9949	0.9939	0.9929	0.9919	0.9909
0.9990	0.9980	0.9969	0.9959	0.9949	0.9939	0.9929	0.9918	0.9908
0.9990	0.9979	0.9969	0.9959	0.9948	0.9938	0.9928	0.9918	0.9907
0.9990	0.9979	0.9969	0.9958	0.9948	0.9938	0.9927	0.9917	0.9906
0.9989	0.9979	0.9968	0.9958	0.9947	0.9937	0.9926	0.9916	0.9905

0.9979	0.9957	0.9936	0.9915	0.9894	0.9872	0.9851	0.9830	0.9809
0.9989	0.9978	0.9967	0.9957	0.9946	0.9935	0.9924	0.9913	0.9902
0.9989	0.9978	0.9967	0.9956	0.9945	0.9934	0.9923	0.9912	0.9901
0.9989	0.9978	0.9967	0.9956	0.9944	0.9933	0.9922	0.9911	0.9900
0.9989	0.9978	0.9966	0.9955	0.9944	0.9933	0.9921	0.9910	0.9899
0.9989	0.9977	0.9966	0.9955	0.9943	0.9932	0.9920	0.9909	0.9898
0.9989	0.9977	0.9966	0.9954	0.9943	0.9931	0.9920	0.9908	0.9897
0.9988	0.9977	0.9965	0.9953	0.9942	0.9930	0.9919	0.9907	0.9895
0.9988	0.9976	0.9965	0.9953	0.9941	0.9929	0.9918	0.9906	0.9894
0.9988	0.9976	0.9964	0.9952	0.9940	0.9929	0.9917	0.9905	0.9893
0.9988	0.9976	0.9964	0.9952	0.9940	0.9928	0.9916	0.9904	0.9892
0.9988	0.9976	0.9963	0.9951	0.9939	0.9927	0.9915	0.9902	0.9890
0.9988	0.9975	0.9963	0.9951	0.9938	0.9926	0.9914	0.9901	0.9889
0.9975	0.9950	0.9925	0.9900	0.9875	0.9850	0.9825	0.9800	0.9775
0.9987	0.9974	0.9962	0.9949	0.9936	0.9923	0.9910	0.9897	0.9885
0.9987	0.9974	0.9961	0.9948	0.9935	0.9922	0.9909	0.9896	0.9883
0.9987	0.9974	0.9961	0.9947	0.9934	0.9921	0.9908	0.9895	0.9882
0.9987	0.9973	0.9960	0.9947	0.9933	0.9920	0.9907	0.9893	0.9880
0.9986	0.9973	0.9959	0.9946	0.9932	0.9919	0.9905	0.9892	0.9878
0.9986	0.9973	0.9959	0.9945	0.9932	0.9918	0.9904	0.9890	0.9877
0.9986	0.9972	0.9958	0.9944	0.9931	0.9917	0.9903	0.9889	0.9875
0.9972	0.9944	0.9915	0.9887	0.9859	0.9831	0.9803	0.9775	0.9747
0.9986	0.9971	0.9957	0.9942	0.9928	0.9913	0.9899	0.9884	0.9870
0.9985	0.9971	0.9956	0.9941	0.9926	0.9912	0.9897	0.9882	0.9868
0.9985	0.9970	0.9955	0.9940	0.9925	0.9910	0.9896	0.9881	0.9866
0.9985	0.9970	0.9955	0.9939	0.9924	0.9909	0.9894	0.9879	0.9864
0.9985	0.9969	0.9954	0.9938	0.9923	0.9908	0.9892	0.9877	0.9862
0.9984	0.9969	0.9953	0.9938	0.9922	0.9906	0.9891	0.9875	0.9859
0.9984	0.9968	0.9952	0.9937	0.9921	0.9905	0.9889	0.9873	0.9857
0.9984	0.9968	0.9952	0.9935	0.9919	0.9903	0.9887	0.9871	0.9855
0.9984	0.9967	0.9951	0.9934	0.9918	0.9902	0.9885	0.9869	0.9852
0.9983	0.9967	0.9950	0.9933	0.9917	0.9900	0.9883	0.9867	0.9850
0.9983	0.9966	0.9949	0.9932	0.9915	0.9898	0.9881	0.9864	0.9847
0.9983	0.9966	0.9948	0.9931	0.9914	0.9897	0.9879	0.9862	0.9845
0.9982	0.9965	0.9947	0.9930	0.9912	0.9895	0.9877	0.9860	0.9842
0.9982	0.9964	0.9946	0.9929	0.9911	0.9893	0.9875	0.9857	0.9839
0.9982	0.9964	0.9945	0.9927	0.9909	0.9891	0.9873	0.9855	0.9836
0.9981	0.9963	0.9944	0.9926	0.9907	0.9889	0.9870	0.9852	0.9833
0.9981	0.9962	0.9943	0.9925	0.9906	0.9887	0.9868	0.9849	0.9830

0.9981	0.9962	0.9942	0.9923	0.9904	0.9885	0.9865	0.9846	0.9827
0.9980	0.9961	0.9941	0.9922	0.9902	0.9882	0.9863	0.9843	0.9824
0.9980	0.9960	0.9940	0.9920	0.9900	0.9880	0.9860	0.9840	0.9820
0.9980	0.9959	0.9939	0.9918	0.9898	0.9878	0.9857	0.9837	0.9816
0.9979	0.9958	0.9938	0.9917	0.9896	0.9875	0.9854	0.9833	0.9813
0.9979	0.9957	0.9936	0.9915	0.9894	0.9872	0.9851	0.9830	0.9809
0.9978	0.9957	0.9935	0.9913	0.9891	0.9870	0.9848	0.9826	0.9804
0.9978	0.9956	0.9933	0.9911	0.9889	0.9867	0.9844	0.9822	0.9800
0.9977	0.9955	0.9932	0.9909	0.9886	0.9864	0.9841	0.9818	0.9795
0.9977	0.9953	0.9930	0.9907	0.9884	0.9860	0.9837	0.9814	0.9791
0.9976	0.9952	0.9929	0.9905	0.9881	0.9857	0.9833	0.9810	0.9786
0.9976	0.9951	0.9927	0.9902	0.9878	0.9854	0.9829	0.9805	0.9781
0.9975	0.9950	0.9925	0.9900	0.9875	0.9850	0.9825	0.9800	0.9775
0.9974	0.9949	0.9923	0.9897	0.9872	0.9846	0.9821	0.9795	0.9769
0.9974	0.9947	0.9921	0.9895	0.9868	0.9842	0.9816	0.9789	0.9763
0.9973	0.9946	0.9919	0.9892	0.9865	0.9838	0.9811	0.9784	0.9757
0.9972	0.9944	0.9917	0.9889	0.9861	0.9833	0.9806	0.9778	0.9750
0.9971	0.9943	0.9914	0.9886	0.9857	0.9829	0.9800	0.9771	0.9743
0.9971	0.9941	0.9912	0.9882	0.9853	0.9824	0.9794	0.9765	0.9735
0.9970	0.9939	0.9909	0.9879	0.9848	0.9818	0.9788	0.9758	0.9727
0.9969	0.9938	0.9906	0.9875	0.9844	0.9813	0.9781	0.9750	0.9719
0.9968	0.9935	0.9903	0.9871	0.9839	0.9806	0.9774	0.9742	0.9710
0.9933	0.9867	0.9800	0.9733	0.9667	0.9600	0.9534	0.9467	0.9400
0.9964	0.9929	0.9893	0.9857	0.9821	0.9786	0.9750	0.9714	0.9679
0.9963	0.9926	0.9889	0.9852	0.9815	0.9778	0.9741	0.9704	0.9667
0.9962	0.9923	0.9885	0.9846	0.9808	0.9769	0.9731	0.9692	0.9654
0.9960	0.9920	0.9880	0.9840	0.9800	0.9760	0.9720	0.9680	0.9640
0.9958	0.9917	0.9875	0.9833	0.9792	0.9750	0.9708	0.9667	0.9625
0.9957	0.9913	0.9870	0.9826	0.9783	0.9739	0.9696	0.9652	0.9609
0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9950	0.9900	0.9850	0.9800	0.9750	0.9700	0.9650	0.9600	0.9550
0.9947	0.9895	0.9842	0.9789	0.9737	0.9684	0.9632	0.9579	0.9526
0.9944	0.9889	0.9833	0.9778	0.9722	0.9667	0.9611	0.9556	0.9500
0.9941	0.9882	0.9824	0.9765	0.9706	0.9647	0.9588	0.9530	0.9471
0.9938	0.9875	0.9813	0.9750	0.9688	0.9625	0.9563	0.9500	0.9438
0.9933	0.9867	0.9800	0.9733	0.9667	0.9600	0.9534	0.9467	0.9400
0.9929	0.9857	0.9786	0.9714	0.9643	0.9572	0.9500	0.9429	0.9358
0.9923	0.9846	0.9769	0.9692	0.9615	0.9539	0.9462	0.9385	0.9308
0.9917	0.9833	0.9750	0.9667	0.9583	0.9500	0.9417	0.9334	0.9251

0.9909	0.9818	0.9727	0.9636	0.9546	0.9455	0.9364	0.9273	0.9183
0.9900	0.9800	0.9700	0.9600	0.9500	0.9400	0.9301	0.9201	0.9101
0.9889	0.9778	0.9667	0.9556	0.9445	0.9334	0.9223	0.9112	0.9002
0.9875	0.9750	0.9625	0.9500	0.9375	0.9251	0.9126	0.9002	0.8877
0.9857	0.9714	0.9572	0.9429	0.9286	0.9144	0.9002	0.8860	0.8718
0.9833	0.9667	0.9500	0.9334	0.9168	0.9002	0.8836	0.8671	0.8506
0.9800	0.9600	0.9400	0.9201	0.9002	0.8803	0.8605	0.8407	0.8210
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9002	0.8013	0.7045	0.6106	0.5206	0.4354	0.3558	0.2826	0.2167

Source: calculated by researcher used Stata

MWKM = S**(t) = $\prod_{x\leq t} w_j[1 - d(x)/n(x)]$, where w_j=1-sin(cj*Pj)/n

Table (4.25): MWKM survival probability for last 2-children in 5 diseases

MWKM (if value of p_j=0.1,0.2,0.3,0.4,0.5,0.6,0.7,0.8,0.9)								
0.9500	0.9002	0.8506	0.8013	0.7526	0.7045	0.6571	0.6106	0.5650
0.9002	0.8013	0.7045	0.6106	0.5206	0.4354	0.3558	0.2826	0.2167

Source: calculated by researcher used Excel

Table (4.26): Test of equality of the survival distribution functions (DF = 4**)**

Statistic	Observed value	Critical value	Sig	Alpha
Log-rank	180.259	9.488	< 0.0001	0.050
Wilcoxon	115.583	9.488	< 0.0001	0.050
Tarone-Ware	145.444	9.488	< 0.0001	0.050

Source: calculated by researcher used Stata

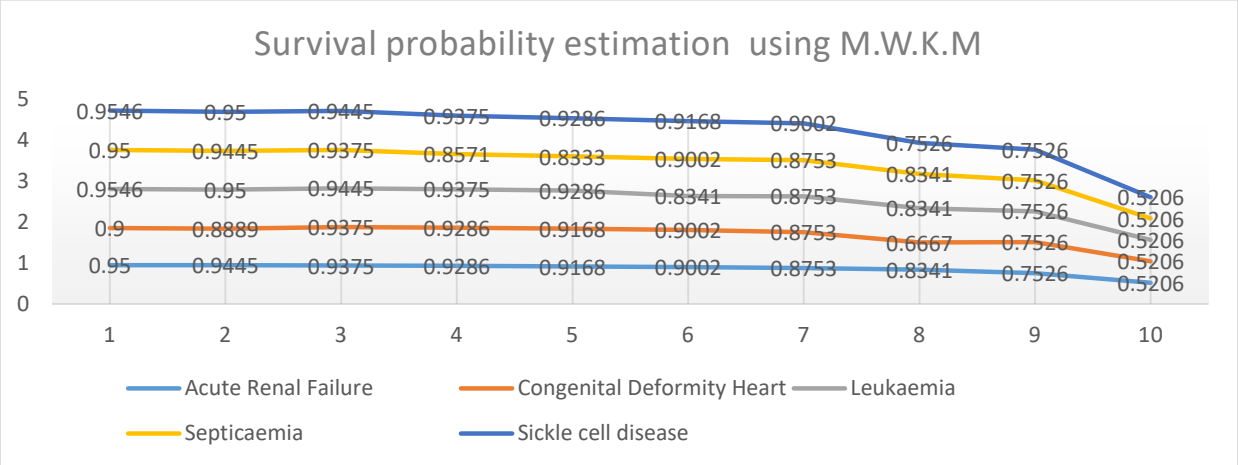
Table (4.26), show Wilcoxon and Tarone estimation for the survival distribution function for the large censored data to improve the bias of K.M in estimating the probability of survival values (Tarone, 1977). While MWKM for 5 groups have estimated the probability of survival over time for the last censored Child was (1.00) for each group, while when the probability of survival (p_j) approximately equal 0.1 to 0.9, then MWKM for the 10-last observation equal 0.9002 to 0.2167 for each group. The consequence result of the MWKM for this dataset if $p_j = 0.5$ is (0.5206 to 1.00).

Table (4.27): MWKM result for the last 10 censored children ($p_j = 0.5$)

Acute Renal Failure	Congenital Deformity Heart	Leukemia	Sepicaemia	Sickle cell disease
0.9500	0.9000	0.9546	0.9500	0.9546
0.9445	0.8889	0.95	0.9445	0.95
0.9375	0.9375	0.9445	0.9375	0.9445
0.9286	0.9286	0.9375	0.8571	0.9375
0.9168	0.9168	0.9286	0.8333	0.9286
0.9002	0.9002	0.8341	0.9002	0.9168
0.8753	0.8753	0.8753	0.8753	0.9002
0.8341	0.6667	0.8341	0.8341	0.7526
0.7526	0.7526	0.7526	0.7526	0.7526
0.5206	0.5206	0.5206	0.5206	0.5206

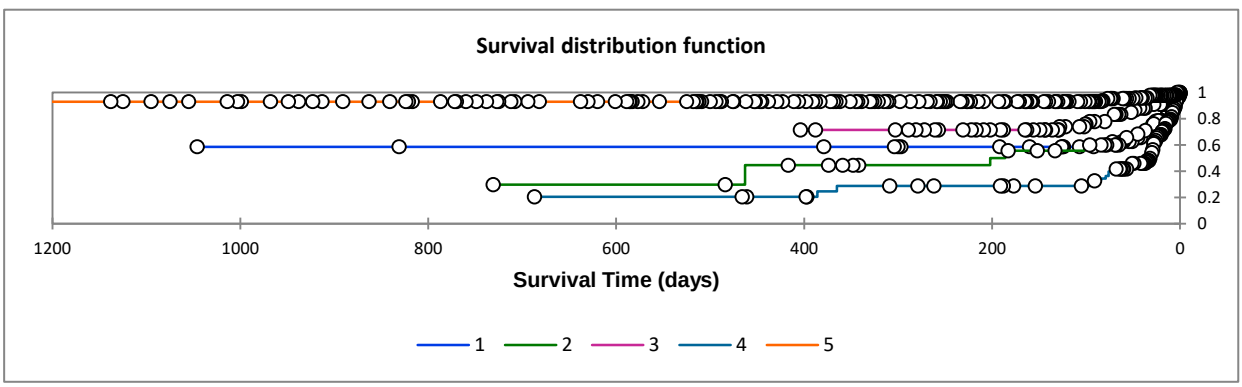
Source: calculated by researcher used Excel

Figure (4.14): Survival probability estimation for the last 10 censored children



Source: charted by researcher using Excel

Figure (4.15): Survival probability for 5 diseases used MWKM



Source: charted by researcher using Excel

Table (4.28a): Variable Summary Report and Break per Gender= Male

Variables	Mean	Median	SE	Min	Max	Interquartile Range	25th Percentile	75th Percentile
Age	494	90	26.2	1	1820	719	11	730
Stage	2	2	0	2	2	0	2	2
Symptoms	1	1	0.02	1	2	0	1	1
Disease Type	4	4	0.05	1	5	2	3	5
Disease History	2	2	0	2	2	0	2	2
Height (cm)	57	48.5	1.36	0	155	23	39	62
Weight (kg)	7	3	0.42	0	161	7.7	2.3	10
No of hospital visit	1	1	0.02	1	4	0	1	1
Status	0.2	0	0.02	0	1	0	0	0
Survival time	101	17	8.85	0	1719	66.75	7	73.75

Source: calculated by researcher used Excel

Table 4.28b: Variable Summary Report, Break per Gender= Female

Variables	Mean	Median	SE	Min	Max	Inter quartile Range	25th Percentile	75th Percentile
Age	605	210	33	1	1820	1082	13	1095
Stage	2	2	0	2	2	0	2	2
Symptoms	1	1	0.02	1	2	0	1	1
Disease Type	4	4	0.06	1	5	2	3	5
Disease History	2	2	0	2	2	0	2	2
Height (cm)	58	47	1.87	0	165	43	37	80
Weight (kg)	9	4	0.50	0	110	10.6	2.4	13
No of hospital visit	1	1	0.03	1	4	0	1	1
Status	0.2	0	0.02	0	1	0	0	0
Survival time	111	14.5	11.27	0	1816	67.5	6	73.5

Source: calculated by researcher used Stata

In column two Mean has appeared because of included Age variable. Critical Values of the χ^2 Distribution, survival time is defined as the point at which the Children cannot get more survivor to live. It was a measure the observation per disease.

Step 1. Set up hypotheses and determine level of significance.

H_0: The five population medians are equal versus

H_1: The five population medians are not all equal α=0.05

Step 2. Select the appropriate test statistic.

The test statistic for the Kruskal Wallis test is denoted H and is defined as follows:

$$H = \left(\frac{12}{N(N+1)} \sum_{j=1}^{k} \frac{{R_j}^2}{n_j} \right) - 3(N+1)$$

where k=the number of comparison groups, N= the total sample size, n_j is the sample size in the j^{th} group and R_j is the sum of the ranks in the j^{th} group. In the censored children data, the outcome was continuous, but the sample sizes are small and not equal across comparison diseases group (n_1=78, n_2=80, n_3=79, n_4=328, n_5=298). Thus, a nonparametric test is appropriate. The hypotheses tested are given below, with used a 5% level of significance.

$$H = \left(\frac{12}{1098(1098+1)} \left(\frac{(49039.5)^2}{100} + \frac{(46499)^2}{104} + \frac{(66049.5)^2}{78} + \frac{(218344)^2}{483} + \frac{(223419)^2}{313} \right) \right) - 3(1098+1) = 9.39$$

Step 3. Set up the decision rule.

Step 4. Compute the test statistic.

To conduct the test, we have assigned ranks using the procedures outlined above. The first step in assigning ranks is to order the data from smallest to largest. This was done on the combined or total sample (i.e., pooling the data from the five comparison groups (n=863)), and assigning ranks from 1 to 863, as follows. We also need to keep track of the group assignments in the total sample.

Table (4.29): Kruskal-Wallis equality-of-populations rank test for survival time

Disease Type	Obs.	Rank Sum	Chi-square (H)	Sig
Acute Renal Failure	100	49039.5	159.045	0.0001
Congenital Deformity Heart	104	46499		
Leukemia	98	66049.5		
Septicaemia	483	218344		
Sickle cell disease	313	223419		

Source: calculated by researcher used Stata

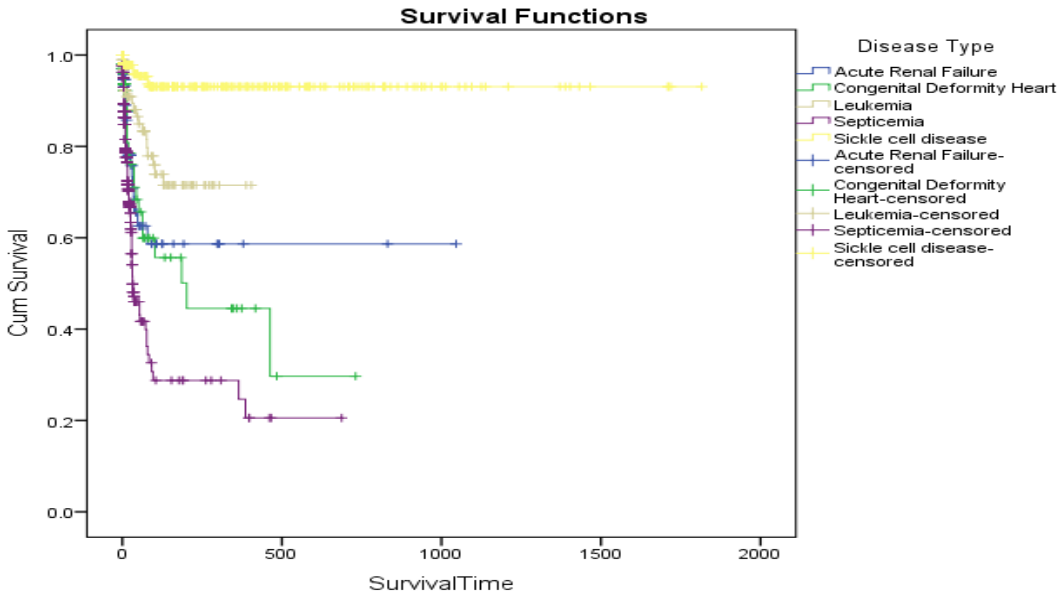
Critical Values of *H* (Kruskal Wallis) test, to determine the appropriate critical value, we need sample sizes for example (n_1=100, n_2=104, n_3=98, n_4=483 and n_5=313) and level of significance (α=0.05), the critical value of H is equal 9.39, therefore, H_0 has rejected because 159.045>9.39, the result concluded that there was difference in median. If there are 3 or more comparison groups and 5 or more observations in each group, the test shown the statistic H approximates a chi-square distribution with df=k-1. Thus, the critical value for that test could be found in the table of Critical Values of the χ^2 distribution.

Step 5. Conclusion

Reject H_0 because 159.045>9.39. We have statistically significant evidence at α =0.05, to show that there was a difference in median survival time thresholds among the five different groups of children [1.2.3.4.5]. Similarly, if the last observation is censored and number of events was less than 50% it is not

possible to calculate the median survival time (Slud, 1984). A typical pattern of the Kaplan-Meier survival curve is shown in Figure (4.16).

Figure (4.16): Kaplan-Meier survival curve



Source: charted by researcher using Excel

Given survival curves of five groups. This was an informal procedure because sometimes the difference between groups may exist but not significant. A more formal procedure is using the Log-rank test which is the most powerful test against the alternatives to the hazard functions (Fleming and Harrington, 1991),

Table (4.30): Events observed and expected per diseases

Disease Type	Events Observed	Events expected
Acute Renal Failure	25	17.19
Congenital Heart Deformity	29	27.9
Leukemia	23	36.57
Septicaemia	180	97.48
Sickle cell disease	20	97.86
Total	277	277

Source: calculated by researcher used Stata

Table (4.30) show the events observed and expected per disease, which realized the largest expected events in Septicaemia and sickle cell disease.

Table (4.31): K.M estimate the survival function (events) vs. types of diseases

Stratum	Total observed	Total died	Total censored	Time steps(days)
Acute Renal Failure	100	22	78	51
Congenital Deformity Heart	104	24	80	53
Leukemia	98	19	79	70
Septicaemia	483	155	328	75
Sickle cell disease	313	15	298	195
Overall	1098	235	863	444

Source: calculated by researcher used Stata

Table (4.32): Gender qualitative variable

Variable	Categories	Frequencies	%
Gender	Male	628	57.195
	Female	470	42.805

Source: calculated by researcher used Stata

Figure (4.17a): The probability of sample size power

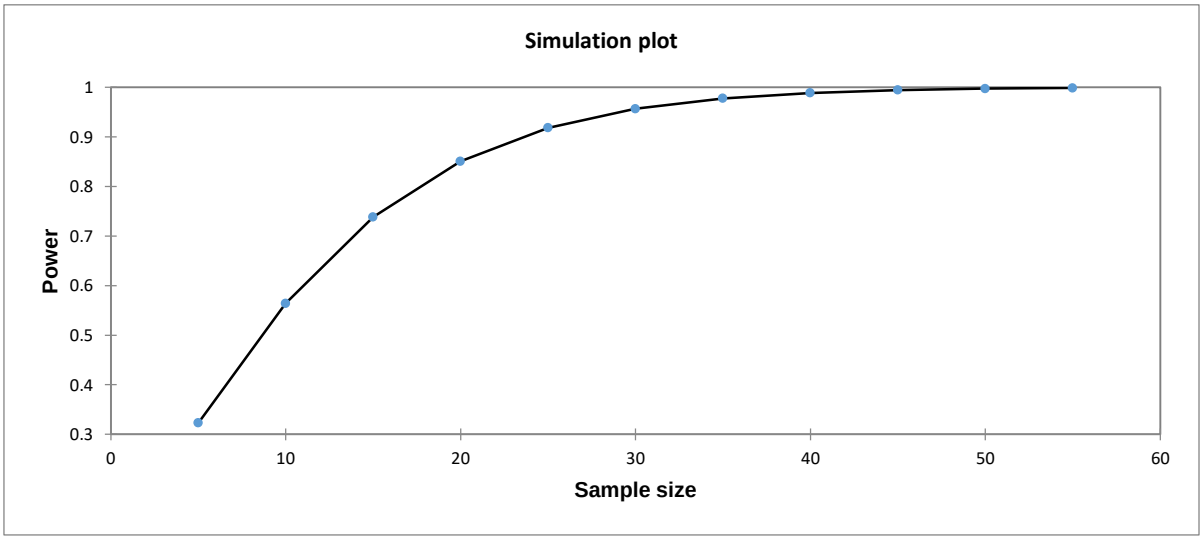
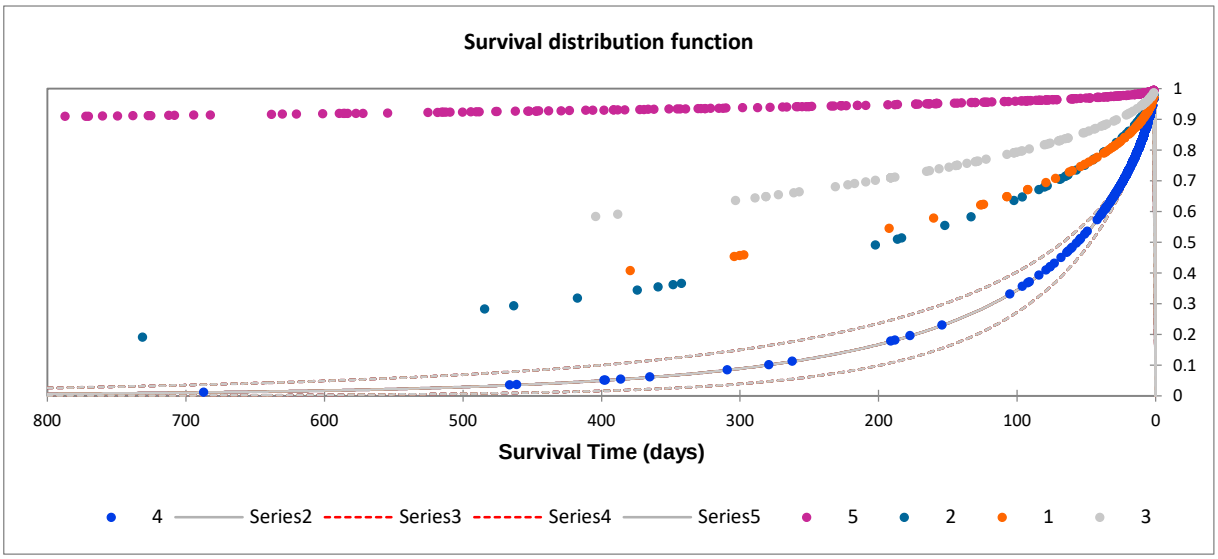


Figure (4.17a) show the trend of probability power when increased with increasing the sample size.

Figure (4.17b): Weibull comparison survival curve for 5 diseases



Source: charted by researcher using XLStat

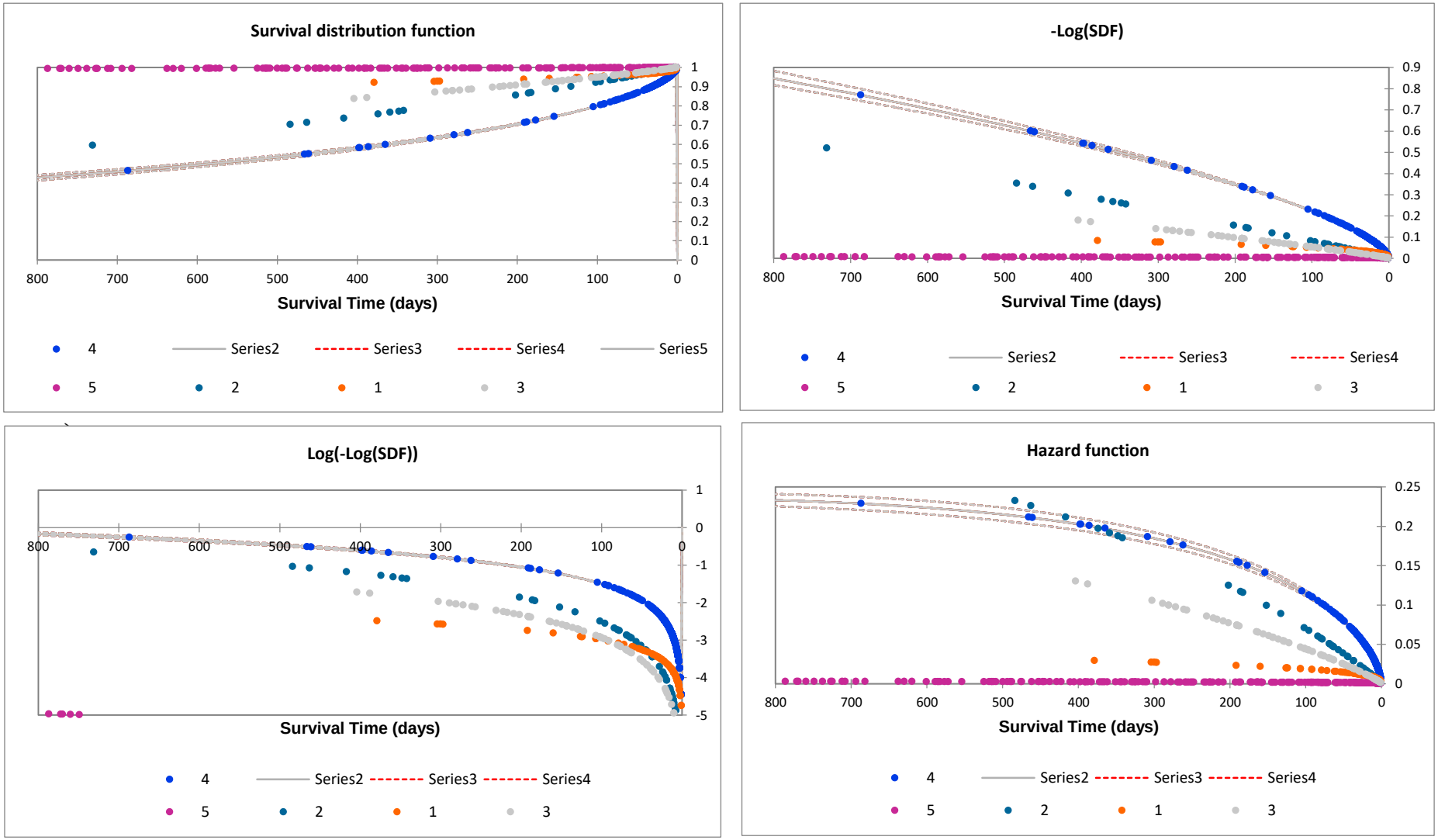
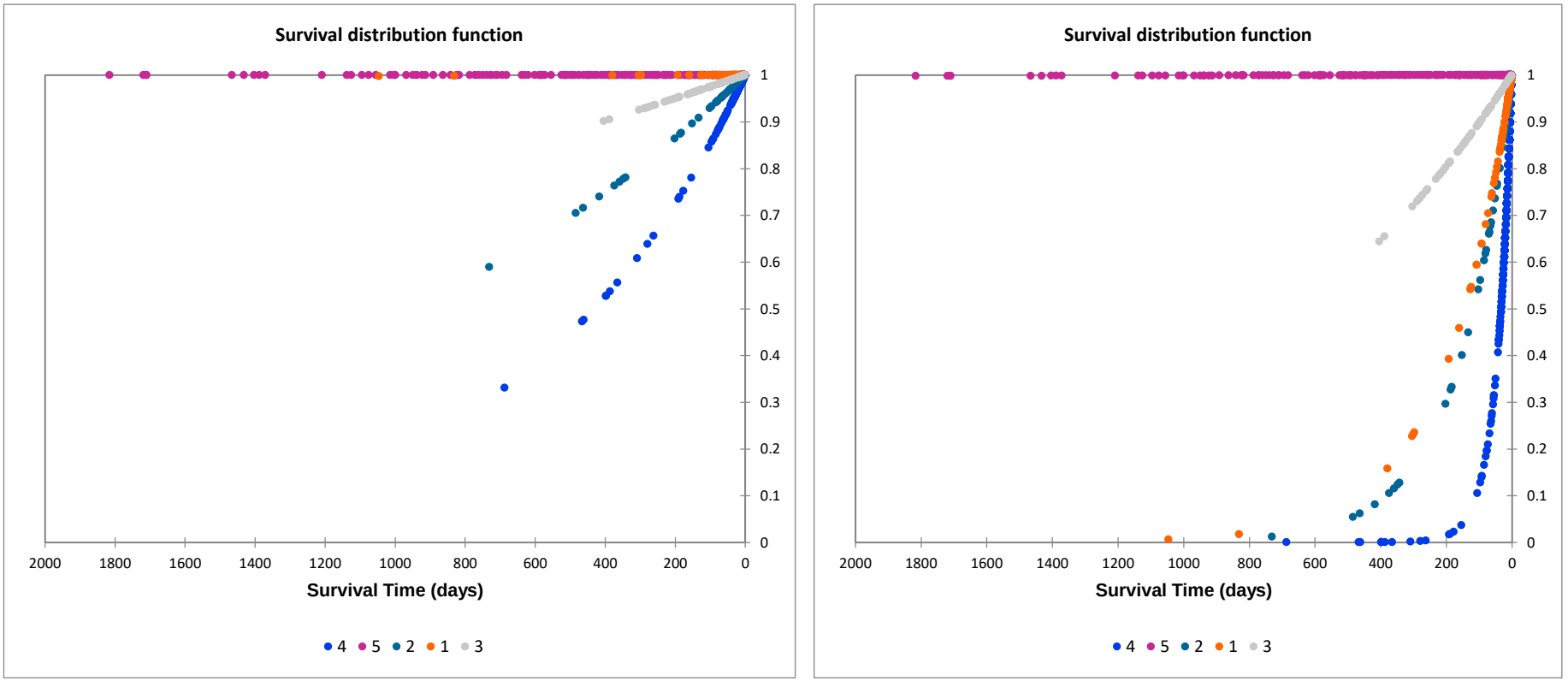


Figure (4.17c): Weighted Weibull comparison survival curve for 5 diseases

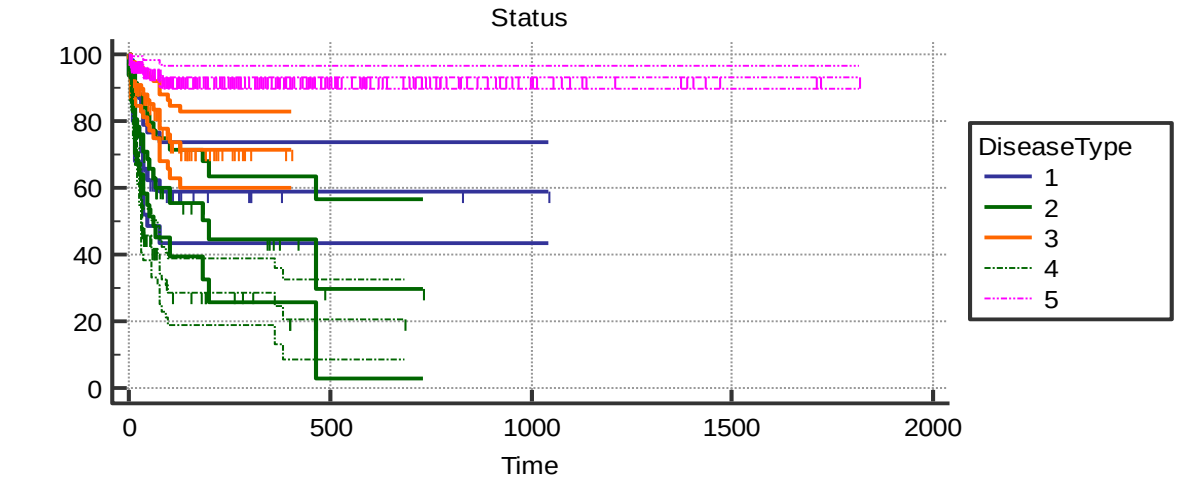


(a) (b)

Fig (4.18): lognormal survival curve (a) and weighted lognormal survival curve (b) comparison of 5 diseases

Source: charted by researcher using XLstata

Figure (4.19): Survivor time and children<5 at risk per diseases



Number at risk

Group: 1				
97	2	1	0	0
Group: 2				
102	1	0	0	0
Group: 3				
98	0	0	0	0
Group: 4				
477	1	0	0	0
Group: 5				
309	60	17	4	0

Source: charted by researcher using NCSS

Figure (4.19) show the survival probability of children at risk per group. The percentage of children at risk admitted with Acute Renal Failure from first hours of birth to 500 days were 97%, from 500 to 1000 days of birth were 2% and from 1000 to 1500 days of birth were1%; The percentage of children at risk admitted with Congenital Deformity Heart from first hours of birth to 500 days were 98%, from 500 to 1000 days of birth were 1% and 1% of children were lost to follow-up or withdrew; The percentage of children at risk admitted with Leukemia in first hours of birth to 500 days were 100%; The percentage of children at risk admitted with Septicaemia from first hours of birth to 500 days were 99% and from 500 to 1000 days of birth were 1%; The percentage of children at risk admitted with Sickle cell disease from first hours of birth to 500 days were 99% and from 500 days of birth 1%

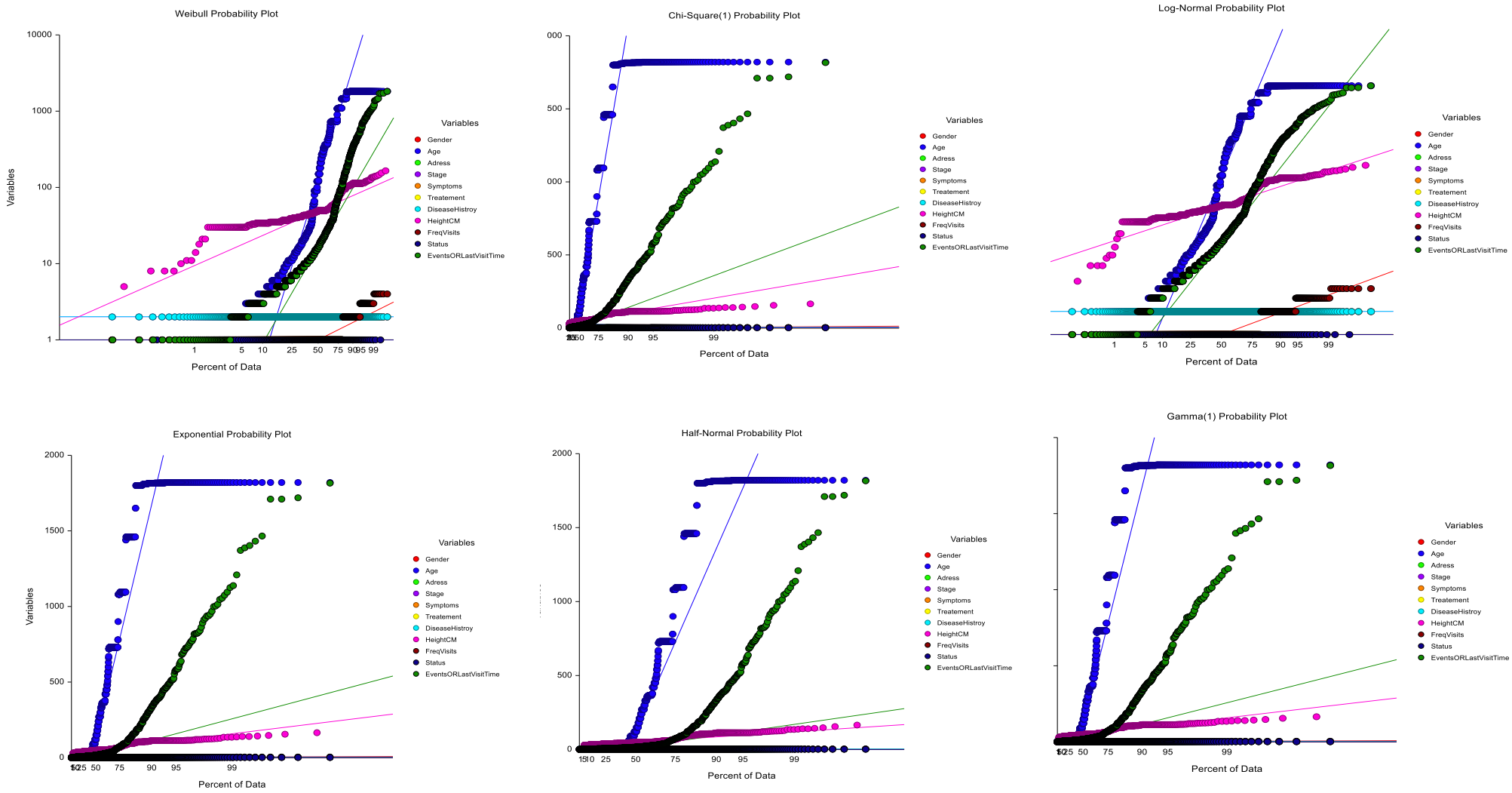


Figure (4.20): Comparison of AFT models for time of diseases progression vs. percentage of the targeted children

Source: charted by researcher using XLStat

Table (4.33): Weibull Accelerated Failure Time Model

No. of subjects = 740 Number of obs = 740

No. of failures = 211 Time at risk = 92244

R chi2(9) = 899.63 Log likelihood = -340.54526

Sig > chi2 = 0.0000

Ind. Var	Coef.	Std. Err.	z	P>z	[95% Conf.Interval]	
gender	0.196357	0.156268	1.26	0.209	-0.10992	0.502637
age	0.001293	0.000346	3.74	0	0.000615	0.00197
address	-0.00358	0.003371	-1.06	0.289	-0.01019	0.003029
stage	0	(omitted)				
symptoms	0.263837	0.201043	1.31	0.189	-0.1302	0.657874
disease type	-0.01447	0.092287	-0.16	0.875	-0.19535	0.166408
Disease history	0	(omitted)				
Height(cm)	-0.01314	0.005288	-2.48	0.013	-0.0235	-0.00277
Weight(kg)	-0.01718	0.013641	-1.26	0.208	-0.04392	0.009552
Freq. visits	0.914808	0.27639	3.31	0.001	0.373095	1.456522
status	-23.3644	897.0593	-0.03	0.979	-1781.57	1734.839
_cons	25.1832	897.0596	0.03	0.978	-1733.02	1783.388
/ln_p	-0.10167	0.050117	-2.03	0.043	-0.19989	-0.00344

Table (4.34): Akaike's information criterion and Bayesian information criterion

Model	Obs	11(null)	11(model)	df	AIC	BIC
.	740	-716.596	-326.472	12	676.9434	732.2232

Note: N=740 used in calculating BIC.

Table (4.35) shows that The log-likelihoods and likelihood ratio (LR) tests, for comparing the variables selected, and the disease type-3 (leukemia) was not significant with the variables selected, which means after comparing the goodness of fit expressed that how many times more likely children with leukemia than the other diseases. Each of which has no unknown parameters, use of the likelihood ratio, test can be justified by the Neyman–Pearson lemma, which demonstrates that such a test has the highest power among all competitors (Neyman and pearson, 1933).

In addition to compare all these AFT models using statistical criteria (likelihood ratio test and AIC). According to the LR test, AIC and BIC used to compare the models. The Weibull AFT model and exponential models appeared more better appropriate in contrast to others AFT models according to AIC compared with other AFT models, also noted that the Lognormal10 and Log logistic models have poor fits according to reliability scale, LR test and AIC (table 4.36). This provided more evidence that the PH assumption for this data was not appropriate. The signs of the coefficients in the AFT model were opposite to the signs for the PH model. The parameter shapes have estimated in each population sample and found that in Weibull model less than in exponential i.e., in ARF was 0.5677 in Weibull and 1in exponential, which proofed that the Weibull model was better than the exponential model for this dataset.

Table (4.35): Reliability of Parametric Distributions per disease

Disease Type	Distribution	Likelihood	Shape	Scale	Threshold
1- Acute Renal Failure	Lognormal	-125.997	5.409682	2.433229	0
	Lognormal10	-125.997	2.349395	1.056738	0
	Log logistic	-127.448	5.294861	1.397007	0
	Weibull	-129.386	0.567694	490.9924	0
	Exponential	-138.593	1	270.3333	0
	Normal	-172.699	349.3678	279.6106	0
	Logistic	-173.05	264.0041	134.1991	0
	Extreme Value	-182.169	617.0684	306.4729	0
2- Congenital Deformity Heart	Lognormal	-154.168	5.038924	2.065283	0
	Lognormal10	-154.168	2.188377	0.896941	0
	Log logistic	-155.254	4.981978	1.178544	0
	Weibull	-157.036	0.672031	313.8727	0
	Exponential	-162.265	1	242.4	0
	Normal	-193.267	265.6699	200.9359	0
	Logistic	-194.933	233.582	111.8613	0
	Extreme Value	-202.677	422.3636	202.8603	0
3- Leukemia	Lognormal	-131.322	6.820292	2.8427	0
	Lognormal10	-131.322	2.962015	1.234569	0
	Log logistic	-131.995	6.57346	1.514593	0

	Weibull	-132.338	0.602867	1122.779	0
	Exponential	-136.478	1	484.4737	0
	Normal	-152.436	295.1775	186.9853	0
	Logistic	-154.555	292.5666	112.1247	0
	Extreme Value	-156.314	362.3981	138.9928	0
4- Septicaemia	Lognormal	-791.842	3.830626	1.678018	0
	Normal	-791.842	1.66362	0.728754	0
	Lognormal10	-791.842	1.66362	0.728754	0
	Log logistic	-794.65	3.727124	0.930826	0
	Weibull	-812.412	0.745538	91.03753	0
	Exponential	-830.751	1	78.23225	0
	Logistic	-1020.71	60.34185	34.67565	0
	Extreme Value	-1153.51	235.2127	149.1812	0
5- Sickle cell disease	Lognormal	-129.094	13.68694	5.319224	0
	Lognormal10	-129.094	5.944163	2.31011	0
	Loglogistic	-130.251	12.33992	2.482912	0
	Weibull	-130.402	0.391783	311060.1	0
	Exponential	-144.212	1	5509.133	0
	Normal	-163.624	2199.519	1086.968	0
	Logistic	-165.746	2110.581	568.3794	0
	Extreme Value	-166.21	2272.061	609.8297	0

Source: calculation based on NCSS

Another attitude, the study shows the benefit of preventive therapies to delay the death of infected children is not confirmed, but there was signing to reduce the children hazard. The Cox PH model, Cox model with time dependent variables, piecewise exponential model and the AFT model to this dataset have been applied, as well the corresponding of the results and compared the main methods of Cox and AFT. However, the interaction between variables increased fatality (Ackah AA et al.,1995) caused significant morbidity and mortality.AFT method has been preferred in survival analysis to reduce the children healthy challenges and difficulties have been faced.

The complexities provided by the presence of censored observations led to develop a new field of statistical method. Although Bayesian methods in

survival analysis are well developed and becoming quite common for survival data, but it was focused on frequents methods (IBRAHIM et al.,2001).

This study touches the partial likelihood ratio inference for Cox's type of models and AFT models. It was demonstrated that the parametric and semiparametric models provided various flexibility in modeling survival data. For analysis of asymptotic properties of the non-or semi-parametric components in Cox's type of models, counting processes and their associated martingales play an important role. For more details, interested readers can consult with Fan, Gijbels, and King (2007); (Cai et al., 2007). However, there are many approaches to model survival data. Parametric methods for censored data are covered in detail by Kalbfleisch and Prentice (1980, Chapters 2 and 3) and by Lawless (1982, Chapter 6). Semiparametric models with unspecified baseline hazard function are studied in (Cox and Oakes, 1984). Martingale methods were also used to study the parametric models (Borgan, 1984) and semiparametric models (Fleming and Harrington) 2005; (Andersen et al., 1993). While parametric methods work well for homogeneous samples, they don't determine whether certain variables are related to the survival times. Although, Cox PH model became the most widely used for the analysis of survival data in the presence of covariates or prognostic factors, because of its simplicity and not being based on any assumptions about the survival distribution and the model assumes that the underlying hazard rate was a function of the independent covariates, but no assumptions are made about the nature or shape of the hazard function. The AFT model become another alternative method for the analysis of survival data.

5. Result and Recommendation

5.1 Result

This section is interpreted the use of nonparametric and semiparametric methods in processing the large censoring data in estimating the survival probabilities analysis for children<5 years. In addition, comparison between K-M vs. WKM vs. MWKM, also comparison between Proportional Hazard Models vs. Accelerated Failure Time Models, and how different statistical packages are solving the concerned issues. These data are recorded from 2012 to 2016 on:

1- Survival time S(t)
2- gender, age, date of admitted and last visit, stage of children when admitted, symptoms, treatment taken, disease in family history, child height (cm), child weight (kg), freq. of hospital visit, the status (death and censor).

Stir reports point estimatation and confidence intervals for the incidence rate ratio (IRR) and incidence rate difference. Stratified IRRs has standardized to produce standardized mortality ratios stir used with single or multiple record and single or multiple failure S(t) data. This study is conducted on 1098 patients of children<5 years undergone surgery, 100 with Acute Renal Failure (22 died, 78 censored and median of survival time was16-day); 104 with Congenital Deformity Heart (24 died and 80 censored and median of survival time was 16-day); 98 with Leukemia (19 died and 79 censored and median of survival time was 16-day); 483 with Septicaemia (155 died and 328 censored and median of survival time was 6-day) and 313 with Sickle cell disease (15 died and 298 censored and median of survival time was 16-day)). Total status of these patients was 235 (21%) died by the end of the study and 863 (79%) were censored (Table 4.19). The overall survival median time of children was 16-day with

survival rate (0.97), as well as standard error and a 95% confidence interval for both methods. The estimation calculated according to Kaplan Meier vs. Weighted Kaplan-Meier are presented in (Table 4.9), where the Weighted Kaplan-Meier presented better estimations (lower standard errors and shorter confidence intervals). Survival probabilities derived from both methods as shown in (Figures 11a&b), which illustrated that both methods are approximately close to other at the begin of the study where the rate of censoring is low, but when time passes, and the rate of censoring increased the Kaplan-Meier estimations is bias in survival probability. Weighted Kaplan-Meier presented nonzero estimation of survival probability to the last censored observations but not accurate, while MWKM gives the accurate probability survival time to the las censored child equal "1" to the last censored Child, and if P_j equal 0.1 to 0.9, the accurate probability survival time to the las censored child equal equal 0.2167 to 0.9002 (Tables 4.22 to 4.26). However, the data were not following the normal distribution, Kruskal Wallis test has shown difference in the rank within 5 diseases and hazard ratio between affected children as well. The AFT model is alternative to the PH model in analyzing the large censoring survival data, and after tested the goodness-of-fit via AIC&BIC have found the Weibull AFT model is fitted more better, more valuable and realistic to PH models. MWKM and AFT model has usfull interpreted the survival analysis of heavy censored data.

5.1.1 Findings

1- A finding of the presented study was the absence of protection of children<5 yrs. The study cited similar studies that estimated the risk of covariates with the baseline signs symptoms variables in the Cox PH model. To overcome this time-dependent covariate are incorporated into the Cox model. Also, different AFT models were used to fit the data and found that the Weibull

and exponential AFT models have better fitting for this dataset (Table 4.35). The study provided the predicted hazard functions, predicted survival functions, median survival times and time ratios under Weibull AFT model. Thus, the independent variables were significantly associated with the diseases progression. Although, females <5 years have longer time in survival and disease progression than males <5 years, but their risks progression of mortality was higher than male. According to the Weibull AFT model, variables prolongs the time to disease progression was increased. Furthermore, AFT model has explanatory advantage in treatment benefit in terms of an effect on expected duration of illness, as well in the covariates have a direct effect on survival times rather on hazard functions as in the PH model. The AFT model was an alternative method for the analysis of survival data even when hazards are not proportional. The proportion of children will survive past a sure time and the proportion of survive is increased due according to increase the survival time.

2- The survival rate for censored children affected with 5 diseases is estimated as 0.98% based on Weighted Kaplan Meier, which was lower than Kaplan-Meier estimation 0.99% (Table 4.9). The high survival rate estimated by Kaplan-Meier during study period was unexpected because of heavy censored assumption (Utley et al., 2000).
3- Multiple causes of children death will be considered after study timeframe.
4- The probability of survival has increased or decreased proportionality to increase or decrease the survival rate (Table 4.21 - 4.25).
5- We can ensure that the children censored till end of the study are recoverd as resulted in Tables (4.20 to 4.24) for the 2-last censored children probability of survival time was equal “1”

6- MWKM estimate the probability survival time to the last censored child per disease was 0.2167 to 0.9002, If survival rate p_j=0.1 the S^{**}=0.9002 and if p_j=0.9 the S^{**}=0.2167 (table 4.26).
7- There was difference hazard ratio between affected children with 5 diseases.
8- There was a differentiation in estimation the heavy censored children data between K-M vs. WKM vs. MWKM & Cox PH vs. AFT models.
9- The Sensitivity and specificity of the diseases towards the Sudanese children under 5 years (True positive, True Negative, False positive, False negative of Survival Time) in figure (4.3).
10- Female <5 years, have longer survival time till progression time than male <5 years, but their risks progression of mortality was higher than male <5 years (Table 4.12).

5.2Recommendations

1- More studies with the similar dataset can apply a MWKM with AFT model; MWKM with AFT and Time Series due to forecast the status of withdrawal and losted follow-up children.
2- There is a steady minimal declining in both under 5 mortality rate and neonatal mortality rate among children, but they need more effort from the authorities, health professionals, communities and families.
3- In the setting of Sudan, the common causes of morbidity and mortality, reasonably equipped the pediatric units with adequately training may save children live.
4- International funding programs for communicable diseases and charity organizations should include such diseases management in their programs.

5- Sudanese health authority to give attention to the children death causes e.g preterm birth complications (pneumonia “intrapartum-related events”, neonatal sepsis, diarrhea, malnutrition and undernutrition).
6- Readers should do more investigation children healthy cost to Sudanese Gross Domatci Poroduct.
7- To reduce child mortality rate, there needs to be better education, higher standards of healthcare and more caution in childbearing, attendance of professionals at birth and breastfeeding through access clean water, sanitation, and immunization.
8- Policy interventions allow health systems to improve equity and reduce mortality for instance low-tech, evidence-based, cost-effective measures such as vaccines, antibiotics, micronutrient supplementation, insecticide-treated bed nets, improved family care and breastfeeding practices, and oral rehydration therapy; Empowering women; removing financial and social barriers to accessing basic services; developing innovations that make the supply of critical services more available to the poor and increasing local accountability of the health systems.

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Appendix

A. Sample of data 1098 children affected with 5 epidemic disease at Jafar Ibn Oaf Paediatric Hospital from 2012 to 2016

Gender: 1 Male & 2 Female;

When patient come to hospital (1: Satge 1 (well condition); Satge 2 (50% well); Satge 3 (bad condition))

Disease Type= (1: Acute Renal Failure; 2: Congenital Deformity Heart; 3: Leukaemia; 4: Septicaemia; 5: Sickle cell disease)

Status (1: Death & 0: Censored)

File No	Gender	Age(day)	Address	Date	Stage	Symptoms	Disease Type	Treatment	Disease History	Height(cm)	Weight(kg)	Freq. Hospital Visits	Exist Date	Status	Survival Time (days)
31377	1	10	Abu Adam-Khartoum	3-Oct-13	2	1	4	Softx + Fanco + Dextrose	2		2.7	1	10-Oct-13	0	7
33241	1	3	Abu Adam-Khartoum	22-Aug-14	2	1	4	SoftX + Fanco	2		3.9	1	29-Aug-14	0	7
31197	1	1460	Abu Adam-Khartoum	18-Feb-16	2	1	5	Dextrose + Caenola + Sftax	2	107	14.8	3	25-Feb-16	0	7
38	1	1460	Abu Adam-Khartoum	18-Feb-12	2	1	5	Dextrose + Caenola + Sftax	2	107	14.8	3	2-Nov-16	0	1719
37762	2	180	Abu Gibeha-Kurdofan	5-Mar-16	2	1	2	Laxxy + SoftX	2		5	1	10-Mar-16	0	5
37547	2	1816	Abu Gibeha-Kurdofan	6-Feb-16	2	1	5	Samson + Cainola + Morphine	2		20	2	25-May-16	0	109
46	1	1816	Abu Gibeha-Kurdofan	6-Feb-16	2	1	5	Samson + Cainola + Morphine	2	113	25	2	27-Dec-16	0	325
11199	1	720	Al Azhari-Khartoum	20-Aug-15	2	1	1	Samson + Cainola	2		9	1	26-Aug-15	0	6
33206	1	210	Al Bagair-Kamlin	3-Sep-14	2	1	2	Maxil + Laxxy + Aventolin	2	61	4.5	1	8-Sep-14	0	5
24574	2	11	Al Bagair-Kamlin	2-May-12	2	1	4	SoftX + Empiclux	2	47	2.5	1	24-May-12	0	22
26547	2	18	Al Bagair-Kamlin	1-Aug-12	2	1	4	Svitax + Calcium + Vitamin K	2		2	1	3-Aug-12	0	2
25271	1	20	Al Bagair-Kamlin	26-May-12	2	1	4	Calcium + Phenytoin	2	34	2.5	1	8-Jun-12	0	13
37922	2	44	Al Bagair-Kamlin	23-Mar-16	2	1	4	SoftX + Fanco	2	39	1	2	28-Apr-16	0	36
24819	2	6	Al Bagair-Kamlin	9-May-12	2	1	4	SoftX + Ampiclox + Calcium	2	47	2.6	1	21-May-12	0	12

40369	2	1800	Al Bagair-Kamlin	1-Jul-12	2	1	5	Samsung + dextrose + folic acid	2		22	2	5-Aug-12	0	35
37508	2	1800	Al Bagair-Kamlin	1-Feb-16	2	1	5	Ventolin + Sftax + Fanco	m ; k[Pk	115	18	1	7-Feb-16	0	6
33331	1	2	Al Daim-Khartoum	7-Sep-14	2	1	4	Fanco + Dextrose	2	45	2	1	21-Sep-14	0	14
36302	1	3	Al Daim-Khartoum	1-Sep-15	2	1	4	SoftX + Fanco	2	34	2.5	1	8-Sep-15	0	7
30659	2	3	Al Daim-Khartoum	27-Jun-13	2	1	4	Sftax + Fanco + Vitamin K	2	45	2.6	1	12-Jul-13	0	15
27740	1	4	Al Daim-Khartoum	5-Oct-12	2	2	4	SoftX + Empiclux	2	51	2.4	1	15-Oct-12	0	10
32605	2	1820	Al Daim-Khartoum	12-May-14	2	1	5	Samcon + Canola	2		14	1	14-May-14	0	2
129	2	730	Al Daim-Khartoum	12-May-13	2	1	5	Samcon + Canola	2	44	3.3	1	30-May-14	0	383
31266	2	60	Al Dwaim-White Nile	19-Sep-13	2	1	2	Laxxy + Spruce + Folic Acid	2		7	1	24-Sep-13	0	5
34567	1	60	Al Dwaim-White Nile	8-Feb-15	2	1	2	Empixlux + Lazixi + SoftX	2		4.5	2	21-Feb-15	0	13
22798	1	11	Al Dwaim-White Nile	12-Feb-15	2	1	4	Dextrose + gentamicin + vitamin K	2		2	1	24-Feb-15	0	12
32435	1	12	Al Dwaim-White Nile	20-Apr-14	2	1	4	SoftX + Fanco	2	53	3.6	1	30-Apr-14	0	10
34471	1	17	Al Dwaim-White Nile	31-Jan-15	2	1	4	Softx + Fanco + Dextrose	2	46	2.3	1	15-Feb-15	0	15
36727	1	18	Al Dwaim-White Nile	23-Oct-15	2	1	4	SoftX + Calcium	2		3.1	1	3-Nov-15	0	11
34242	1	27	Al Dwaim-White Nile	30-Dec-14	2	1	4	Fanko + SoftX	2	40	1.5	1	22-Jan-15	0	23
36026	1	7	Al Dwaim-White Nile	29-Jul-15	2	2	4	Patosium + Vancomycin	2	48	3.9	1	6-Aug-15	0	8
36015	1	7	Al Dwaim-White Nile	28-Jul-15	2	1	4	SPECTAX + FLAGEL + Vitamin K	2		1.2	1	30-Sep-15	0	64
36026	1	7	Al Dwaim-White Nile	29-Jul-15	2	1	4	Dextrose + SoftX	2	47	3.9	1	12-Aug-15	0	14
34306	2	1	Al Dwaim-White Nile	19-Jan-15	2	1	4	Sftax + Fanco + Vitamin D	2	33	1.5	1	20-Mar-15	0	60
35051	2	6	Al Dwaim-White Nile	24-Mar-15	2	2	4	Sftax + Vancomycin	2	34	5.8	1	29-Mar-15	1	5
28896	1	30	Al Dwaim-White Nile	3-Jan-13	2	2	4	Fanco + Sftax + Vitamin K	2	43	1.9	1	4-Jan-13	1	1
255	2	6	Al Dwaim-White Nile	19-Nov-15	2	2	4	Sftax + Vancomycin	2	34	5.8	1	28-Nov-15	1	9
276	2	6	Al Dwaim-White Nile	5-Mar-14	2	2	4	Sftax + Vancomycin	2	34	5.8	1	8-Mar-14	1	3
328	1	30	Al Dwaim-White Nile	6-Apr-13	2	2	4	Fanco + Sftax + Vitamin K	2	43	1.9	1	7-Apr-13	1	1
1	2	1460	Al Emtidad-Khartoum	11-Jan-12	2	1	5	Folek + Entestine	2	104	15	1	31-Dec-16	0	1816
10	1	22	Al Emtidad-Khartoum	18-Dec-15	2	1	5	Samson + Dextrose	2		2.3	1	21-Mar-16	0	94
11	1	90	Al Emtidad-Khartoum	8-Jan-16	2	1	5	Samson + Dextrose	2	30	2	1	21-Mar-16	0	73
13	2	120	Al Emtidad-Khartoum	16-Oct-15	2	1	5	Samson + Morphine	2	30	2	2	21-Mar-16	0	157

213	2	11	Al Emtidad-Khartoum	24-Mar-16	2	1	4	Vancomycin + Formem	2	40	2	1	31-Mar-16	1	7
214	2	12	Al Emtidad-Khartoum	25-Mar-16	2	1	4	Vancomycin + SoftX	2	40	2	1	31-Mar-16	1	6
220	1	10	Al Emtidad-Khartoum	11-Feb-14	2	2	4	Fanko + SoftX	2	37	2	1	17-Feb-14	1	6
227	1	2	Al Emtidad-Khartoum	12-Dec-16	2	2	4	Fanco + Sftax + Vitamin K	2	35	1.9	1	17-Dec-16	1	5
232	1	20	Al Emtidad-Khartoum	9-Jun-14	2	1	4	Calcium	2	39	1.2	1	25-Jun-14	1	16
234	2	10	Al Emtidad-Khartoum	7-Jun-14	2	1	4	Vancomycin + SoftX	2	0	2.6	1	15-Jun-14	1	8
236	2	11	Al Emtidad-Khartoum	20-Oct-14	2	2	4	Fanco + Sftax + Dextrose	2	0	2.3	1	29-Oct-14	1	9
237	1	17	Al Emtidad-Khartoum	20-Oct-14	2	2	4	Fanko + SoftX	2	43	1.3	1	29-Oct-14	1	9
262	2	16	Al Emtidad-Khartoum	9-Nov-14	2	2	4	Flagell	2	30	1.9	1	14-Nov-14	1	5
269	2	11	Al Emtidad-Khartoum	4-Oct-14	2	2	4	SoftX + Fanco	2	37	1	1	21-Oct-14	1	17
275	1	21	Al Emtidad-Khartoum	4-Mar-14	2	1	4	Vancomycin + SoftX	2	35	2.6	1	17-Mar-14	1	13
279	2	11	Al Emtidad-Khartoum	2-Nov-14	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	8-Nov-14	1	6
285	1	4	Al Emtidad-Khartoum	11-Aug-14	2	2	4	Softax + Flagl	2	30	1.8	1	12-Aug-14	1	1
286	1	24	Al Emtidad-Khartoum	11-Aug-14	2	2	4	Fanco	2	34	2.2	1	15-Aug-14	1	4
288	2	30	Al Emtidad-Khartoum	3-Jan-13	2	2	4	Fanco + Sftax + Vitamin K	2	43	1.9	1	3-Jan-14	1	365
289	2	21	Al Emtidad-Khartoum	21-May-14	2	2	4	SoftX + Fanco	2	30	1.6	1	31-May-14	1	10
291	2	300	Al Emtidad-Khartoum	6-Mar-14	2	2	4	Fanko + SoftX	2	43	2.2	1	12-Apr-14	1	37
302	1	30	Al Emtidad-Khartoum	6-Jan-13	2	2	4	SoftX + Fanco	2	30	2	1	11-Jan-13	1	5
325	1	4	Al Emtidad-Khartoum	3-Apr-13	2	2	4	Softax + Flagl	2	43	1.8	1	4-Apr-13	1	1
335	2	90	Al Emtidad-Khartoum	27-Apr-13	2	1	4	Vancomycin + SoftX	2	30	2.6	1	17-May-13	1	20
336	2	35	Al Emtidad-Khartoum	2-Dec-13	2	2	4	Sftax + Vancomycin	2	34	5.8	1	24-Dec-13	1	22
338	1	45	Al Emtidad-Khartoum	7-Jul-13	2	2	4	Fanko + SoftX	2	33	1.3	1	7-Aug-13	1	31
339	2	1	Al Emtidad-Khartoum	7-Aug-13	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	8-Aug-13	1	1
342	1	344	Al Emtidad-Khartoum	17-Aug-13	2	2	4	SoftX + Fanco	2	0	0	1	19-Sep-13	1	33
36361	1	2	Al Geneina-West Darfur	14-Feb-15	2	1	4	SoftX + Fanco	2		2.6	1	20-Dec-15	0	309
40925	1	1820	Al Gerafe Sharig-Khartoum	20-May-15	2	1	5	Dextrose + Sftrax + Canola	2		26	2	12-Dec-16	0	572
33977	1	1815	Al Gerafe Sharig-Khartoum	30-Nov-14	2	1	3	Ventolin + Maxil + Hidcertzone	2	104	16	1	3-Dec-14	0	3
35427	2	150	Al Gerafe-Khartoum	10-May-15	2	1	2	Laxzy + Maxell + Espero	2	65	4.7	1	16-May-15	0	6

32308	1	1800	Al Gerafe-Khartoum	5-Apr-14	2	1	4	Fanco + Sftax + Dextrose	2		4	1	13-Apr-14	0	8
22438	1	15	Al Gerafe-Khartoum	28-Jan-12	2	1	4	SoftX + Fanco	2	50	2.7	1	3-Feb-12	0	6
27906	1	4	Al Gerafe-Khartoum	17-Oct-12	2	1	4	Samsung + ampiclux	2	50	2.9	1	27-Oct-12	0	10
28143	1	5	Al Gerafe-Khartoum	1-Nov-12	2	1	4	Samson + Vitamin K	2	33	3.4	1	6-Nov-12	0	5
33351	2	4	Al Kadaro-Khartoum	9-Sep-14	2	1	4	Dextrose + SoftX	2	46	2.4	1	12-Sep-14	0	3
30745	2	90	Al Managel-Al Gezira	8-Jul-13	2	2	2	Laxix + Cephotaxin	2			3	18-Nov-13	0	133
37433	1	1460	Al Managel-Al Gezira	21-Jan-16	2	1	5	SoftX + SaiVin	2	105	15	1	26-Jan-16	0	5
210	2	330	Al Managel-Al Gezira	8-Jul-14	2	2	2	Laxix + Cephotaxin	2	45	3	3	15-Jun-15	0	342
37447	1	14	Al Manasir-Norh Sudan	3-Feb-16	2	1	4	Fanco	2	52	2.2	1	16-Feb-16	0	13
37114	2	730	Al Mujlad-Kurdofan	14-Jul-15	2	1	5	Samson + Fanco + Dextrose	2		10.4	2	10-Aug-15	0	27
28731	1	1095	Al Mujlad-Kurdofan	19-Dec-12	2	1	5	Samsung + sftax + dextrose	2		12	2	17-Jan-13	0	29
36848	2	1820	Al Mujlad-Kurdofan	8-Nov-15	2	1	5	Samson + Canola + Vitamin (A)	2		14	1	19-Nov-15	0	11
28731	1	1095	Al Mujlad-Kurdofan	19-Dec-12	2	1	5	Dextrose + Caenola + Fanco + Sftrax	2		12	2	9-Jan-13	0	21
32	1	730	Al Mujlad-Kurdofan	14-Dec-15	2	1	5	Samson + Fanco + Dextrose	2	50	3	2	24-Mar-16	0	101
97	1	150	Al Mujlad-Kurdofan	19-Jan-16	2	1	5	Samsung + sftax + dextrose	2	34	2	2	19-Apr-16	0	91
110	1	1817	Al Mujlad-Kurdofan	8-Nov-13	2	1	5	Samson + Canola + Vitamin (A)	2	113	25	1	15-Nov-14	0	372
36851	1	1810	Al Mujlad-Kurdofan	11-Jul-15	2	2	1	Dextrose + Fanco + Sodium	2	137	25	1	11-Aug-15	1	31
382	1	335	Al Mujlad-Kurdofan	1-Feb-13	2	2	1	Dextrose + Fanco + Sodium	2	38	2.8	1	11-Feb-13	1	10
35625	1	330	Al Nohood-Kurdofan	31-May-15	2	1	1	Seftrax + Laxxy + Dextrose + Samson	2	11	6.4	2	4-Oct-15	0	126
34195	1	1095	Al Nohood-Kurdofan	28-Dec-14	2	1	1	Dextrose + Hydrecertone	2		13	1	6-Jan-15	0	9
35137	1	1805	Al Nohood-Kurdofan	2-Apr-15	2	1	1	Fanko + Samson	2			3	4-Aug-15	0	124
38827	1	55	Al Nohood-Kurdofan	25-Jun-16	2	1	2	Softx + Lazyx + Pendulum	2	56	3	1	29-Aug-16	0	65
192	2	370	Al Nohood-Kurdofan	31-May-15	2	1	1	Seftrax + Laxxy + Dextrose + Samson	2	35	2.5	2	23-Mar-16	0	297
203	1	1095	Al Nohood-Kurdofan	28-Dec-12	2	1	1	Dextrose + Hydrecertone	2	95	13	1	6-Jun-13	0	160
37020	1	120	Al Nohood-Kurdofan	30-Nov-15	2	2	2	Dopamine + adrenaline + fanco + dextrose	2	56	3.4	1	13-Dec-15	1	13
362	1	120	Al Nohood-Kurdofan	30-Nov-15	2	2	3		2	56	3.4	1	13-Dec-15	1	13
385	1	120	Al Nohood-Kurdofan	30-Nov-15	2	2	2	Dopamine + Adrenaline + Fanco + Dacstrom	2	36	2.7	1	3-Jun-16	1	186
32369	1	7	Al Nuba-Khartoum	2-Jan-14	2	2	2		2	45	3.5	2	14-Apr-14	1	102

376	1	7	Al Nuba-Khartoum	2-Jan-14	2	2	3		2	30	2	2	14-Apr-14	1	102
33521	2	150	Al Obiet-Kurdofan	4-Oct-14	2	1	1	Samaxon + Kinin + Ventolin + Dextrose	2			2	4-Jan-15	0	92
31413	1	1820	Al Obiet-Kurdofan	10-Oct-13	2	1	1	Sodium + laxi + zinc syrup	2	100	12	1	13-Oct-13	0	3
38047	1	1820	Al Obiet-Kurdofan	6-Apr-16	2	1	1	Vancomacin + Caniola	2	120	19	1	28-Apr-16	0	22
31183	2	1815	Al Obiet-Kurdofan	8-Sep-14	2	1	1	Fanco + Embrazole + Dextrose + Sftax	2	115	22	2	7-Nov-14	0	60
37315	2	1816	Al Obiet-Kurdofan	9-Jan-16	2	1	1	Lexus + Samson	2	140	43	1	20-Jan-16	0	11
37456	1	1820	Al Obiet-Kurdofan	4-Feb-16	2	1	1	Samson + Fanco + Dextrose	2	114	16	1	8-Feb-16	0	4
32449	1	1095	Al Obiet-Kurdofan	21-Apr-14	2	1	2	Oxygen + laxi + dactone	2	84	21	1	29-Apr-14	0	8
32400	2	1095	Al Obiet-Kurdofan	15-Apr-14	2	1	2	Sprou + Laaxy + Maxell	2	86	9	1	20-Apr-14	0	5
39061	1	1810	Al Obiet-Kurdofan	25-Aug-16	2	1	3	Dextrose + Fanco + Adrenaline + Laxex	2		23	1	30-Aug-16	0	5
36654	1	13	Al Obiet-Kurdofan	16-Oct-15	2	2	4	Potassium + Vancomycin	2		4.4	1	26-Oct-15	0	10
36654	1	13	Al Obiet-Kurdofan	16-Oct-15	2	1	4	SoftX + Fanco	2	37	4.4	1	26-Oct-15	0	10
39118	1	15	Al Obiet-Kurdofan	2-Sep-16	2	1	4	SoftX + Fanco	2		2.4	1	22-Sep-16	0	20
38104	2	27	Al Obiet-Kurdofan	14-Apr-16	2	1	4	Fanko + SoftX	2	45	2.1	1	5-May-16	0	21
26170	2	2	Al Obiet-Kurdofan	14-Jul-12	2	1	4	SoftX + Empiclux	2		2.3	1	19-Jul-12	0	5
28261	2	40	Al Obiet-Kurdofan	11-Nov-12	2	1	4	SoftX + Canola	2	40	1.5	1	6-Dec-12	0	25
30992	1	7	Al Obiet-Kurdofan	22-Aug-13	2	1	4	Softx + Fanco + Dextrose	2	50	2.8	1	19-Sep-13	0	28
31836	1	8	Al Obiet-Kurdofan	8-Jan-14	2	1	4	SoftX + Fanco + Lazixi	2	46	2.3	1	3-Feb-14	0	26
31482	1	270	Al Obiet-Kurdofan	15-Dec-13	2	1	5	Laxxy + SoftX	2		22	2	24-Apr-14	0	130
33807	2	730	Al Obiet-Kurdofan	11-Nov-14	2	1	5	Adrenaline + Hydrocertose + Intest	2			1	20-Nov-14	0	9
37094	2	1820	Al Obiet-Kurdofan	14-Dec-15	2	1	5	Adrenaline + Hydrocertose + Intest	2		18	2	8-Jan-16	0	25
36811	2	1800	Al Obiet-Kurdofan	2-Nov-15	2	1	5	Samsung + fanko + antistine	2	124	25	1	29-Nov-15	0	27
18	1	365	Al Obiet-Kurdofan	15-Dec-15	2	1	5	Laxxy + SoftX	2	45	3	2	31-Oct-16	0	321
87	1	730	Al Obiet-Kurdofan	11-Nov-13	2	1	5	Adrenaline + Hydrocertose + Intest	2	50	3	1	20-Oct-14	0	343
140	2	730	Al Obiet-Kurdofan	21-Feb-14	2	1	3		2	50	3.2		3-Jun-14	0	102
154	1	330	Al Obiet-Kurdofan	25-Dec-12	2	1	3	Dextrose + Fanco + Adrenaline + Laxex	2	35	2.2	1	30-Jul-13	0	217
162	2	730	Al Obiet-Kurdofan	21-Aug-15	2	1	3		2	50	3.2		10-Mar-16	0	202
176	1	90	Al Obiet-Kurdofan	25-Jan-16	2	1	3	Dextrose + Fanco + Adrenaline + Laxex	2	50	2.3	1	30-Apr-16	0	96

196	1	150	Al Obiet-Kurdofan	4-Jun-15	2	1	1	Samaxon + Kinin + Ventolin + Dextrose	2	37	3	2	29-Jun-15	0	25
38851	1	17	Al Obiet-Kurdofan	7-Aug-16	2	2	4	Fanko + SoftX	2	43	1.3	1	7-Nov-16	1	92
217	1	15	Al Obiet-Kurdofan	27-Nov-16	2	2	4	Fanko + SoftX	2	43	1.3	1	30-Nov-16	1	3
35281	2	1460	Al Rahad-Kurdofan	21-Apr-15	2	1	5	Inselin injection + Canola	2		11	1	22-Apr-15	0	1
104	2	330	Al Rahad-Kurdofan	21-Apr-12	2	1	5	Inselin injection + Canola	2	35	2.4	1	15-Nov-14	0	938
31668	2	4	Al Sahafa-Khartoum	26-Nov-13	2	1	4	SoftX + Fanco	2		2.4	1	5-Dec-13	0	9
30417	2	6	Al Sahafa-Khartoum	26-May-13	2	1	4	SoftX + AmpClose + Calcium + Vitamin	2	45	3.6	1	2-Jun-13	0	7
29171	1	1	Al Sahafa-Khartoum	23-Jan-13	2	1	4	SoftX + Empiclux	2	37	2.6	1	7-Feb-13	0	15
39008	1	1095	Al Sahafa-Khartoum	18-Aug-16	2	1	3	Samson + DXDroz + Vancomacey	2		11	1	7-Sep-16	0	20
21667	1	11	Al Salama-Khartoum	21-Dec-12	2	1	4	SoftX + Fanco	2		2.5	1	31-Dec-12	0	10
29987	1	18	Al Salama-Khartoum	22-Apr-13	2	1	4	Ampiclux + Sftax + Oxygen	2	47	3.4	1	29-Apr-13	0	7
32105	2	33	Al Salama-Khartoum	9-Apr-14	2	1	4	SoftX + Fanco	2	41	1.6	1	18-Apr-14	0	9
34518	1	4	Al Salama-Khartoum	5-Feb-15	2	1	4	SoftX + Fanco	2		2.6	1	22-Feb-15	0	17
26585	1	5	Al Salama-Khartoum	6-Aug-12	2	1	4	Penicillin + Sftax	2	50	3.8	1	9-Aug-12	0	3
28317	1	6	Al Salama-Khartoum	16-Nov-12	2	1	4	SoftX + Empiclux	2	41	3	1	22-Nov-12	0	6
36774	1	270	Al Salama-Khartoum	28-Oct-15	2	1	5	Dextrose + Adrenaline + Anticin	2		9	1	5-Nov-15	0	8
22136	2	210	Al Salha-Omdorman	11-Jan-12	2	1	2	Maxi + Canola	2		4.7	1	13-Jan-12	0	2
37122	1	24	Al Salha-Omdorman	10-Sep-13	2	1	4	SoftX + Fanco	2	49	3.8	1	20-Dec-14	0	466
35129	1	9	Al Salha-Omdorman	31-Mar-15	2	1	4	Softx + Fanco + Dextrose	2	52	3.7	1	6-Apr-15	0	6
34061	1	1820	Al Salha-Omdorman	11-Dec-14	2	1	5	Adrenaline + Hydrocertose + Intest	2		20	3	22-Aug-16	0	620
115	2	1815	Al Salha-Omdorman	11-Dec-13	2	1	5	Adrenaline + Hydrocertose + Intest	2	113	25	3	15-Nov-14	0	339
22255	2	1	Al Samrab-Khartoum	17-Jan-12	2	1	4	Svitax + Vitamin K	2		1.3	1	22-Feb-12	0	36
28270	1	730	Al Samrab-Khartoum	14-Nov-12	2	1	5	Samson + Dextrose	2		9	2	13-Jan-13	0	60
91	1	120	Al Samrab-Khartoum	14-Jan-16	2	1	5	Samson + Dextrose	2	35	2	2	13-Apr-16	0	90
38063	2	1820	Al Samra-Khartoum	9-Apr-16	2	2	1	Fanco + Sftax + Dextrose	2	120	18	1	23-Apr-16	1	14
34735	2	730	Al Shigilab-Khartoum	13-Aug-15	2	1	5	Cainola + Sftrexon	2		8	1	18-Aug-15	0	5
21	2	730	Al Shigilab-Khartoum	13-Aug-15	2	1	5	Cainola + Sftrexon	2	50	3	1	31-Oct-16	0	445
30493	2	9	Al Shigla-Khartoum	6-Jun-13	2	1	4	Penicillin water + Calcium + Sftax	2	45	3	1	17-Jun-13	0	11

34525	1	450	Al Taif-Khartoum	3-Feb-15	2	1	2	Vanko + Formem + Lazksee	2	52	2.4	2	24-Apr-15	0	80
31966	2	270	Al Thora-Omdurman	6-Feb-14	2	1	2	Laxacy + vancomycin	2		4	1	10-Feb-14	0	4
27882	1	1	Al Thora -Omdurman	16-Oct-12	2	1	4	Fanko + SoftX	2	50	3	1	6-Nov-12	0	21
31861	2	5	Al Thora-Omdurman	11-Jan-14	2	1	4	Fanco + Sftax + Vitamin (K)	2	48	2.9	1	20-Jan-14	0	9
35219	1	7	Alasilan-Khartoum	14-Apr-15	2	1	4	Softx + Fanco + Dextrose	2	54	3.5	1	22-Apr-15	0	8
25523	1	4	Alaushra-Khartoum	6-Jun-12	2	1	4	Ventolin + Sftax + Fanco	2		2.2	1	24-Jun-12	0	18
37759	1	1800	Al-Da'een-East Darfur	2-Mar-16	2	1	1	Dextrose + Fanco + Calcium + Laxex	2	123		3	3-May-16	0	62
36602	2	730	Al-Da'een-East Darfur	11-Oct-15	2	1	5	Vancomycin + Amicassin + Caenu	2		10	1	22-Nov-15	0	42
34836	2	730	Al-Da'een-East Darfur	1-Mar-15	2	1	5	Canola + Softrax	2		11	1	7-Mar-15	0	6
38118	1	150	Al-Da'een-East Darfur	15-Apr-16	2	1	5	Samsung + dextrose + canola	2	64	5.4	4	17-May-16	0	32
34365	1	1800	Al-Da'een-East Darfur	18-Jan-15	2	1	5	Habyrin + Canola	2			1	25-Jan-15	0	7
36636	2	1817	Al-Da'een-East Darfur	13-Oct-15	2	1	5	Sphinx + Canola	2		20	1	22-Oct-15	0	9
83	2	730	Al-Da'een-East Darfur	1-Mar-13	2	1	5	Canola + Softrax	2	50	3	1	7-Oct-14	0	585
107	1	365	Al-Da'een-East Darfur	15-Apr-13	2	1	5	Samsung + dextrose + canola	2	45	2.5	4	19-Nov-14	0	583
36394	2	1820	Alkalakla-Khartoum	13-Sep-15	2	1	1	Canola + Sodium + Sftax + Lasx	2	14	96	1	14-Sep-15	0	1
33292	1	90	Alkalakla-Khartoum	1-Sep-14	2	1	2	Laxix + oxygen	2	58	4	1	3-Sep-14	0	2
34049	1	90	Alkalakla-Khartoum	10-Dec-14	2	1	2	SPRU + LASZI	2	55	4.2	1	16-Dec-14	0	6
38683	1	730	Alkalakla-Khartoum	9-Jul-16	2	1	3	Hydrocerton + Dextrose + Samson	2		11	1	13-Jul-16	0	4
25542	2	10	Alkalakla-Khartoum	8-Jun-12		1	4	Empiclux + SoftX	2	46	2.5	1	27-Jun-12	0	19
24535	2	11	Alkalakla-Khartoum	28-Apr-12	2	1	4	SoftX + Fanco	2	50	2.8	1	2-May-12	0	4
35030	1	11	Alkalakla-Khartoum	19-Mar-15	2	1	4	Softx + Fanco + Dextrose	2			1	25-Mar-15	0	6
32149	2	11	Alkalakla-Khartoum	15-Mar-14	2	1	4	Fetamine K + Fanco	2		2.8	1	16-Mar-14	0	1
38545	1	12	Alkalakla-Khartoum	12-Jun-16	2	1	4	Vortem + Vancomycin	2		3	1	18-Jun-16	0	6
4E+05	1	12	Alkalakla-Khartoum	19-Aug-16	2	1	4	SoftX + Fanco	2		3.2	1	27-Aug-16	0	8
24669	1	12	Alkalakla-Khartoum	6-May-12	2	1	4	Gentamicin + penicillin water	2	38	1.3	1	3-Jun-12	0	28
33356	2	12	Alkalakla-Khartoum	10-Sep-14	2	1	4	Sftax + Fanco + Flagel	2		3.4	1	25-Sep-14	0	15
36693	2	14	Alkalakla-Khartoum	20-Oct-15	2	1	4	SoftX + Fanco	2			1	25-Oct-15	0	5
34580	1	17	Alkalakla-Khartoum	11-Feb-15	2	1	4	Vagel + Softax + Vortem	2		3.6	1	6-Mar-15	0	23

24148	2	18	Alkalakla-Khartoum	10-Apr-12	2	1	4	Potassium + Calcium	2	52	2.7	1	12-Apr-12	0	2
25388	1	20	Alkalakla-Khartoum	2-Jun-12	2	1	4	SoftX + ImPlux	2	50	2.7	1	21-Jun-12	0	19
34355	2	29	Alkalakla-Khartoum	16-Jan-15	2	1	4	Sftax + Fanco + Vitamin (K)	2	45	2.7	1	11-Feb-15	0	26
33174	1	2	Alkalakla-Khartoum	16-Aug-14	2	1	4	Sftax + Fanco + Flagel	2	40	1.2	1	4-Sep-14	0	19
4E+05	2	5	Alkalakla-Khartoum	15-Apr-16	2	1	4	Softx + Fanco + Dextrose	2		3.1	1	18-Apr-16	0	3
28758	2	5	Alkalakla-Khartoum	21-Dec-12	2	1	4	SoftX + Fanco	2	50	2.9	1	30-Dec-12	0	9
29434	1	6	Alkalakla-Khartoum	13-Feb-13	2	1	4	SoftX + Empiclux	2	40	2	1	16-Feb-13	0	3
29433	1	6	Alkalakla-Khartoum	14-Feb-13	2	1	4	Sftax + Fanco + Flagel	2		2	1	7-Mar-13	0	21
33218	2	6	Alkalakla-Khartoum	23-Aug-14	2	1	4	Fanko + SoftX	2		2.8	1	30-Aug-14	0	7
31832	1	6	Alkalakla-Khartoum	29-Dec-13	2	1	4	SoftX + Fanco	2	50	3.8	1	12-Jan-14	0	14
34943	1	7	Alkalakla-Khartoum	13-Mar-15	2	1	4	SoftX + Fanco	2	49	3.4	1	20-Mar-15	0	7
34470	1	7	Alkalakla-Khartoum	29-Jan-15	2	1	4	SoftX + Fatco	2	47	2.8	1	2-Feb-15	0	4
27279	1	7	Alkalakla-Khartoum	9-Sep-12	2	1	4	Epiclux + Sftax + Vitamin K	2	51	3	1	17-Sep-12	0	8
28788	2	1	Alkalakla-Khartoum	24-Dec-12	2	1	4	Sftaki + laxi + fanco	2	42	1.9	1	22-Jan-13	0	29
33386	2	360	Alkalakla-Khartoum	14-Sep-14	2	1	5	Samson + Fanko + Provin	2		10.5	2	30-Nov-14	0	77
36249	1	450	Alkalakla-Khartoum	25-Aug-15	2	1	5	Dextrose + Caenola + Sftax + Pendulum	2		10	1	31-Aug-15	0	6
34732	2	1820	Alkalakla-Khartoum	2-Mar-15	2	1	5	Samson + Dextrose	2			1	5-Mar-15	0	3
33223	2	1820	Alkalakla-Khartoum	25-Sep-14	2	1	5	Heparin + folic + antistine	2			2	11-Nov-14	0	47
36249	1	300	Alkalakla-Khartoum	25-Aug-15	2	1	5	Samsung + dextrose + canola	2		10	1	31-Aug-15	0	6
36975	1	730	Alkalakla-Khartoum	7-Jan-16	2	1	5	Samson + Dextroz	2			1	12-Jan-16	0	5
34615	2	1460	Alkalakla-Khartoum	14-Mar-12	2	1	5	Samson + Fanco	2		26	2	22-Feb-15	0	1075
32898	1	1820	Alkalakla-Khartoum	26-Dec-14	2	1	5	Samsung + sftax	2		14	2	5-Feb-16	0	406
26624	1	240	Alkalakla-Khartoum	17-Aug-12	2	1	1	Lexus + Samson	2		6	2	4-Sep-12	0	18
49	1	1820	Alkalakla-Khartoum	2-Mar-15	2	1	5	Samson + Dextrose	2	113	25	1	27-Feb-16	0	362
56	1	1817	Alkalakla-Khartoum	25-Sep-14	2	1	5	Heparin + folic + antistine	2	113	25	2	27-Dec-16	0	824
62	2	300	Alkalakla-Khartoum	25-Aug-14	2	1	5	Samsung + dextrose + canola	2	30	3	1	8-Jun-15	0	287
92	2	22	Alkalakla-Khartoum	7-Mar-16	2	1	5	Samson + Dextroz	2	30	1.8	1	30-Apr-16	0	54
103	2	270	Alkalakla-Khartoum	14-Mar-12	2	1	5	Samson + Fanco	2	34	2.5	2	7-Nov-14	0	968

130	1	730	Alkalakla-Khartoum	26-Jun-14	2	1	5	Samsung + sftax	2	44	3.3	2	5-Feb-16	0	589
141	1	730	Alkalakla-Khartoum	9-Jul-13	2	1	3	Hydrocerton + Dextrose + Samson	2	50	3.2	1	13-Jan-14	0	188
163	1	730	Alkalakla-Khartoum	9-Jul-15	2	1	3	Hydrocerton + Dextrose + Samson	2	50	3.2	1	22-Mar-16	0	257
36689	1	90	Alkalakla-Khartoum	15-Feb-16	2	1	2	Sftax + laxix + Vancomycin	2	60	4.9	2	17-Feb-16	1	2
34347	1	90	Alkalakla-Khartoum	15-Jan-15	2	2	2	Laxi + maxil + dextrose	2	58	4.9	2	8-Feb-15	1	24
33057	1	120	Alkalakla-Khartoum	21-Jul-14	2	2	2	Sftrax + Fanco + Dextrose	2		4.8	3	8-Feb-15	1	202
371	2	370	Alkalakla-Khartoum	1-Aug-13	2	2	3		2	30	2.2	2	8-Aug-13	1	7
372	1	420	Alkalakla-Khartoum	24-May-13	2	2	3		2	40	3.2	3	9-Aug-13	1	77
31962	2	66	Allamab-Khartoum	13-Mar-14	2	1	2	Laxi + Fanco	2		4	2	1-Apr-14	0	19
34931	2	11	Allamab-Khartoum	11-Mar-15	2	1	4	SoftX + Fanco	2		1.7	1	15-Mar-15	0	4
35436	2	21	Allamab-Khartoum	4-Jun-15	2	1	4	Laxxy + SoftX	2	60	1.9	1	18-Jun-15	0	14
39212	2	25	Allamab-Khartoum	19-Sep-16	2	1	4	Fanko + SoftX	2		2.3	1	6-Oct-16	0	17
33196	1	4	Allamab-Khartoum	19-Aug-14	2	1	4	Fanko + SoftX	2	35	2.9	1	5-Sep-14	0	17
34199	2	1	Allamab-Khartoum	27-Dec-14	2	1	4	Vancomycin + SoftX	2		2.6	1	17-Jan-16	1	386
38574	2	21	Allamab-Khartoum	16-Jun-16	2	2	4	Fanco	2	39	1	1	17-Jun-16	1	1
219	2	9	Allamab-Khartoum	29-Nov-16	2	2	4	Fanco	2	39	1	1	30-Nov-16	1	1
35987	2	180	Arkaweet-Khartoum	25-Jul-15	2	2	2	Laxix + sftax + adraxton	2		6	1	27-Jul-15	0	2
39298	2	13	Arkaweet-Khartoum	28-Sep-16	2	1	4	Fanko + SoftX	2		1.7	1	6-Oct-16	0	8
34858	1	22	Arkaweet-Khartoum	2-Mar-15	2	1	4	Flags + Sftax	2	34	3.2	1	8-Mar-15	0	6
39297	2	27	Arkaweet-Khartoum	28-Sep-16	2	1	4	Steamin (K) + SoftX	2		1.7	1	21-Oct-16	0	23
35351	2	2	Arkaweet-Khartoum	27-Apr-15	2	1	4	Dextrose + SoftX	2		2.6	1	5-May-15	0	8
32289	1	4	Arkaweet-Khartoum	31-Mar-14	2	1	4	Fanco + Vitamin D	2	45	1.8	1	14-Apr-14	0	14
39373	2	7	Arkaweet-Khartoum	11-Oct-16	2	1	4		2		2.3	1	13-Oct-16	0	2
36715	1	1810	Atbara-River Nile	20-Oct-15	2	1	1	Laxxy + Nephane + Dextrose + Atheno	2	111	161	1	25-Oct-15	0	5
34887	1	150	Atbara-River Nile	7-Mar-15	2	1	3	Sftraxidxtrose + morphine	2	68	6	1	10-Mar-15	0	3
39084	2	1810	Atbara-River Nile	28-Aug-16	2	1	3	Canola + Sftrax + Hydrecertone	2		18	1	30-Aug-16	0	2
39341	1	9	Atbara-River Nile	4-Oct-16	2	1	4	SoftX	2		3	1	23-Oct-16	0	19
145	1	730	Atbara-River Nile	7-Mar-14	2	1	3	Sftraxidxtrose + morphine	2	60	5	1	10-Aug-14	0	156

149	1	1080	Atbara-River Nile	28-Aug-12	2	1	3	Canola + Sftrax + Hydrecertone	2	95	13	1	19-Jan-13	0	144
167	1	730	Atbara-River Nile	7-Mar-15	2	1	3	Sftraxidxtrose + morphine	2	48	3.2	1	17-Jun-15	0	102
171	1	730	Atbara-River Nile	28-Aug-16	2	1	3	Canola + Sftrax + Hydrecertone	2	50	3	1	30-Oct-16	0	63
31940	2	1	Azhari-Khartoum	2-Feb-14	2	1	4	Softx + Dextrose	2	48	3	1	23-Feb-14	0	21
30173	1	2	Azhari-Khartoum	7-Sep-15	2	1	4	Fanko + SoftX	2	50	2.4	1	20-Sep-15	0	13
24929	1	3	Azhari-Khartoum	16-May-12	2	1	4	Softx + Dextrose	2	48	2.8	1	24-May-12	0	8
34391	1	45	Azhari-Khartoum	21-Jan-15	2	1	4	Sftax + Fanco + Flagel	2		2.2	1	28-Feb-15	0	38
23513	2	7	Azhari-Khartoum	15-Mar-12	2	1	4	SoftX + Fanco	2		2.8	1	19-Mar-12	0	4
30173	1	7	Azhari-Khartoum	25-Apr-13	2	1	4	Vagel + Sftax + Fanco	2		2.4	1	15-May-13	0	20
38532	1	365	Azhari-Khartoum	3-Jul-16	2	1	5	Canola + Sftrax + Dextrose + Vitamin	2	77	10	3	8-Dec-16	0	158
35024	1	180	Azhari-Khartoum	10-Aug-15	2	1	5	Samson + Lazyxie	2		4.9	1	25-Aug-15	0	15
35821	1	1810	Azhari-Khartoum	23-Jun-15	2	1	5	Adrenaline + Hydrocertose + Intest	2		15	3	28-Dec-16	0	554
69	1	1095	Azhari-Khartoum	3-Jul-15	2	1	5	Canola + Sftrax + Dextrose + Fanco	2	95	13	3	22-Jul-15	0	19
119	2	730	Azhari-Khartoum	10-Aug-14	2	1	5	Samson + Lazyxie	2	45	2.6	1	10-Nov-14	0	92
200	2	720	Azhari-Khartoum	4-Apr-14	2	1	1	Samson + Cainola	2	50	6	1	26-Apr-14	0	22
39414	2	1460	Bahri-Khartoum	16-Oct-16	2	1	1	Penicillin + laxacy	2		17	1	27-Oct-16	0	11
36512	1	510	Bahri-Khartoum	29-Sep-15	2	1	2	Maxil + penicillin watery	2		7	2	5-Oct-15	0	6
36358	1	38	Bahri-Khartoum	7-Sep-15	2	1	2	SoftX + Lazix + Fanco	2	52	3	1	13-Sep-15	0	6
35823	2	1820	Bahri-Khartoum	4-Jun-15	2	1	3	Dextrose + Samxofanco	2	11	18	2	12-Sep-15	0	100
35661	2	10	Bahri-Khartoum	2-Jun-15	2	1	4	SoftX + Fanco	2		3.2	1	10-Dec-15	0	191
33220	1	17	Bahri-Khartoum	23-Aug-14	2	1	4	Sftax + Fanco + Flagel	2	46	1.8	1	9-Sep-14	0	17
31884	1	1	Bahri-Khartoum	20-Jan-14	2	1	4	Empixlux + Fanko + SoftX	2	45	2.1	1	1-Feb-14	0	12
38742	2	20	Bahri-Khartoum	7-Aug-16	2	1	4	Vanko + SoftX + Vitamine (K)	2		4.8	2	20-Aug-16	0	13
29575	1	6	Bahri-Khartoum	2-Mar-13	2	1	4	Ampiclox + Vitamin (K) + SoftX	2	47	3	1	13-Mar-13	0	11
37435	1	1820	Bahri-Khartoum	21-Jun-16	2	1	5	Fanco + Dextrose	2		10	2	27-Nov-16	0	159
12	2	90	Bahri-Khartoum	28-Dec-15	2	1	5	Samson + Fanco	2	30	2	1	21-Mar-16	0	84
111	1	1810	Bahri-Khartoum	21-Jun-13	2	1	5	Fanco + Dextrose	2	113	25	2	15-Nov-14	0	512
150	1	330	Bahri-Khartoum	4-Jun-12	2	1	3	Dextrose + Samxofanco	2	35	2.2	2	12-Jan-13	0	222

172	1	1820	Bahri-Khartoum	4-Jun-16	2	1	3	Dextrose + Samxofanco	2	113	25	2	12-Oct-16	0	130
204	2	1460	Bahri-Khartoum	16-Apr-13	2	1	1	Penicillin + laxacy	2	105	15	1	27-Jun-13	0	72
216	1	14	Bahri-Khartoum	26-Nov-16	2	2	4	Fanco + Sftax + Dextrose	2	5	2	1	30-Nov-16	1	4
247	2	30	Bahri-Khartoum	11-Nov-15	2	2	4	Fanco + Sftax + Vitamin K	2	43	1.9	1	8-Dec-15	1	27
252	2	1	Bahri-Khartoum	19-Nov-15	2	1	4	Calcium	2	35	1.2	1	25-Nov-15	1	6
256	1	11	Bahri-Khartoum	11-Oct-15	2	2	4	Fanco + Sftax + Dextrose	2	35	2.3	1	18-Oct-15	1	7
257	1	17	Bahri-Khartoum	14-Oct-15	2	2	4	Fanko + SoftX	2	43	2.3	1	19-Oct-15	1	5
258	2	9	Bahri-Khartoum	13-Oct-15	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	20-Oct-15	1	7
259	2	21	Bahri-Khartoum	14-Oct-15	2	2	4	Fanco	2	39	3	1	21-Oct-15	1	7
290	2	11	Bahri-Khartoum	29-May-14	2	2	4	SoftX + Fanco	2	37	2	1	7-Jun-14	1	9
292	2	290	Bahri-Khartoum	7-Jan-14	2	1	4	SoftX	2	45	2.6	1	1-Apr-14	1	84
293	2	355	Bahri-Khartoum	8-Jan-14	2	1	4	Calcium	2	39	1.2	1	14-Apr-14	1	96
296	1	150	Bahri-Khartoum	8-Jan-14	2	2	4	Sftax + Vancomycin	2	34	5.8	1	5-Feb-14	1	28
307	1	377	Bahri-Khartoum	15-May-13	2	2	4	Fanko + SoftX	2	41	3.6	1	13-Jun-13	1	29
312	1	35	Bahri-Khartoum	24-Jun-13	2	1	4	SoftX	2	0	2.6	1	24-Jul-13	1	30
314	1	500	Bahri-Khartoum	26-Jun-13	2	1	4	Vancomycin + Formem	2	40	2.7	1	26-Jul-13	1	30
316	2	65	Bahri-Khartoum	2-Jul-13	2	2	4	Sftax + Vancomycin	2	30	1.8	1	29-Jul-13	1	27
324	1	4	Bahri-Khartoum	2-Apr-13	2	2	4	SoftX + Fanco	2	50	2.7	1	3-Apr-13	1	1
333	2	1	Bahri-Khartoum	8-Oct-13	2	1	4	Calcium	2	39	1.2	1	3-Nov-13	1	26
334	2	20	Bahri-Khartoum	9-Oct-13	2	1	4	Vancomycin + Formem	2	0	2.7	1	4-Nov-13	1	26
337	1	11	Bahri-Khartoum	26-Nov-13	2	2	4	Fanco + Sftax + Dextrose	2	0	2.3	1	25-Dec-13	1	29
340	2	21	Bahri-Khartoum	8-Aug-13	2	2	4	Fanco	2	39	1	1	9-Aug-13	1	1
343	2	16	Bahri-Khartoum	10-Sep-13	2	2	4	Flagell	2	0	1.3	1	20-Sep-13	1	10
27569	2	17	Berber-River Nile	25-Sep-12	2	1	4	Epiclux + Dextrose + Vitatione	2	50	3	1	18-Oct-12	0	23
34243	1	27	Berber-River Nile	31-Dec-14	2	1	4	Fanko + Sftax + Fallahil	2	41	1.4	1	26-Jan-15	0	26
80	1	730	Borri and Grafe Garib	21-Feb-14	2	1	5	Samsung + laxi + dextrose	2	50	3	1	11-Jul-14	0	140
271	1	6	Borri and Grafe Garib	5-Oct-14	2	2	4	Fanko + SoftX	2	43	2.2	1	23-Oct-14	1	18
305	1	50	Borri and Grafe Garib	1-Jun-13	2	2	4	Softax + Flagl	2	43	1.8	1	11-Jun-13	1	10

32793	1	9	Borri-Khartoum	6-Jun-14	2	1	4	Fanko + SoftX	2	41	1.2	1	10-Jun-14	0	4
96	1	270	Central Khartoum	20-Jan-16	2	1	5	Sprou + Micasin	2	34	2.5	1	11-Apr-16	0	82
221	1	11	Central Khartoum	12-Feb-14	2	2	4	SoftX + Fanco	2	40	2	1	17-Feb-14	1	5
306	1	90	Central Khartoum	11-May-13	2	2	4	Fanco	2	34	2.2	1	12-Jun-13	1	32
25537	2	10	Children Carehouse	8-Jun-12	2	1	4	SoftX + Empiclux	2	39	1.3	1	11-Jul-12	0	33
17822	2	10	Children Carehouse	17-Jul-12	2	1	4	Sphinx + Empiclux	2	65	3.3	1	28-Jul-12	0	11
28703	2	10	Children Carehouse	17-Dec-12	2	1	4	Ampicluc + Potassium + Fanco	2		2.9	1	12-Jan-13	0	26
25928	2	11	Children Carehouse	2-Jul-12	2	1	4	Softx + Fanco + Dextrose	2	43	2	1	14-Jul-12	0	12
35575	1	12	Children Carehouse	26-May-15	2	1	4	Ampiclox + Samson + Vitamin K	2	46	1.9	1	27-May-15	0	1
22018	1	14	Children Carehouse	15-Jan-12	2	1	4	Fanko + SoftX + ampliclux	2	49	3	1	30-Jan-12	0	15
25872	2	14	Children Carehouse	2-Jul-12	2	1	4	SoftX + Empiclux	2	31	1.9	1	14-Jul-12	0	12
25666	2	1	Children Carehouse	6-Jun-12	2	1	4	Svitax + Vitamin K	2	37	1.7	1	13-Aug-12	0	68
23276	2	20	Children Carehouse	6-Mar-12	2	1	4	Sftax + Fanco + Flagel	2		3	1	9-Mar-12	0	3
25885	2	20	Children Carehouse	30-Jun-12	2	1	4	Penicillin + Sftax	2		2.4	1	8-Jul-12	0	8
27272	2	22	Children Carehouse	24-Sep-12	2	1	4	Sftax + Fanco + Vitamin K	2	40	1.2	1	29-Sep-12	0	5
25188	2	26	Children Carehouse	7-Jun-12	2	1	4	SoftX + Empiclux	2		2	1	29-Jun-12	0	22
21537	2	32	Children Carehouse	19-Dec-12	2	1	4	Softx + Fanco + Dextrose	2	48	2.7	1	30-Dec-12	0	11
34697	1	39	Children Carehouse	24-Feb-15	2	1	4	Svitax + Vitamin D	2	39	1.5	1	31-Mar-15	0	35
21672	2	3	Children Carehouse	1-Mar-13	2	1	4	Laxi + Dextrose + Vitamin K	2	46	1.1	1	5-Mar-13	0	4
28447	2	5	Children Carehouse	3-Dec-12	2	1	4	Sftax + Vancomycin	2		2.5	1	16-Dec-12	0	13
32036	1	5	Children Carehouse	23-Feb-14	2	1	4	Empiclux + Sftax + Fanco	2	45	1.7	1	15-Mar-14	0	20
24311	1	6	Children Carehouse	21-Apr-12	2	1	4	SoftX + Calcium	2	50	2.5	1	7-May-12	0	16
24906	1	7	Children Carehouse	14-May-12	2	1	4	Svitax + Potassium	2	44	1.9	1	5-Jun-12	0	22
35439	1	8	Children Carehouse	5-Jun-12	2	1	4	Sftax + Fanco + Calcium	2		1.4	1	2-Jul-12	0	27
24792	2	9	Children Carehouse	19-Jun-12	2	1	4	SoftX + Fanco	2		1.7	1	29-Jun-12	0	10
32718	2	1	Children Carehouse	27-May-14	2	1	4	SoftX + Fanco	2	40	1.4	1	3-Jun-14	0	7
37597	2	16	Children Carehouse	10-Feb-16	2	2	4	Flagell	2		1.3	1	14-Feb-16	1	4
37327	1	4	Children Carehouse	10-Jan-16	2	2	4	Softax + Flagl	2	43	1.8	1	11-Jan-16	1	1

242	2	24	Children Carehouse	4-May-16	2	2	4	Flagell	2	0	1.3	1	20-May-16	1	16
244	1	26	Children Carehouse	6-May-16	2	2	4	Softax + Flagl	2	43	1.8	1	22-May-16	1	16
264	1	9	Children Carehouse	8-Nov-14	2	2	4	Softax + Flagl	2	43	1.8	1	16-Nov-14	1	8
303	2	16	Children Carehouse	7-Jan-13	2	2	4	Flagell	2	30	1.3	1	22-Jan-13	1	15
345	1	4	Children Carehouse	12-Sep-13	2	2	4	Softax + Flagl	2	43	1.8	1	22-Sep-13	1	10
32520	2	1095	Damazin-Blue Nile	1-May-14	2	1	2	Laxix + blood transfusion tools	2		10	1	6-May-14	0	5
34182	2	15	Damazin-Blue Nile	24-Dec-14	2	1	4	Fanco + Sftax + Calcium	2	53	3.8	1	5-Jan-15	0	12
37615	2	24	Damazin-Blue Nile	13-Feb-16	2	2	4	Fanco	2	34	2.2	1	15-Feb-16	1	2
35657	1	32	Damazin-Blue Nile	3-Jun-15	2	2	1	Canola + Dextrose + Sftax + Milk	2	50	2.5	1	7-Jun-15	1	4
245	2	24	Damazin-Blue Nile	2-Apr-16	2	2	4	Fanco	2	34	2.2	1	15-Apr-16	1	13
32061	1	120	Dar Al Salam-Omdurman	27-Feb-14	2	1	2	Maxil + laxix + oxygen	2	60	3	1	4-Mar-14	0	5
33605	2	180	Dar Al Salam-Omdurman	19-Oct-14	2	1	2	Ventolin + laxacy	2		3	2	11-Nov-14	0	23
31232	1	3	Dar Al Salam-Omdurman	13-Sep-13	2	1	4	Sphinx + Dextrose	2	48	2.7	1	18-Sep-13	0	5
32825	1	4	Dar Al Salam-Omdurman	14-Jun-13	2	1	4	Softx + Fanco + Dextrose	2	45	2.9	1	20-Mar-14	0	279
33875	2	1095	Dar Al Salam-Omdurman	18-Nov-14	2	1	5	Hydrocrackon + Avanco	2	69	9	2	23-Feb-15	0	97
28541	2	1816	Dar Al Salam-Omdurman	5-Dec-12	2	1	5	Samson + Dextrose	2		14	1	20-Dec-12	0	15
95	2	1095	Dar Al Salam-Omdurman	18-Nov-14	2	1	5	Hydrocrackon + Avanco	2	69	9	2	19-Apr-16	0	518
34311	2	1800	Darfur - West Sudan	11-Jan-15	2	1	1	Laxix + Athenol + Hydrolazine	2	165	48	2	22-Feb-15	0	42
36661	2	90	Darfur - West Sudan	17-Oct-15	2	1	5	Samsung + dextrose + canola	2		5.7	1	20-Oct-15	0	3
37213	1	1820	Darfur - West Sudan	28-Dec-15	2	1	5	Fanco + Dextrose + Canola + Sftrax	2		16.5	3	8-Mar-16	0	71
93	2	123	Darfur - West Sudan	17-Feb-15	2	1	5	Samsung + dextrose + canola	2	35	2.1	1	3-Apr-16	0	411
123	1	730	Darfur - West Sudan	28-Dec-13	2	1	5	Fanco + Dextrose + Canola + Sftrax	2	45	3	3	20-May-14	0	143
36274	2	150	Dongola-North Sudan	29-Aug-15	2	1	1	SoftX + Cainola + Glucose	2	57	5	1	30-Aug-15	0	1
38197	2	90	Dongola-North Sudan	24-Apr-16	2	1	2	Laxzy + Maxell + Espero	2		3.5		24-Oct-16	0	183
33951	2	22	Dongola-North Sudan	26-Nov-14	2	1	4	Softx + Fanco + Dextrose	2	50	3	1	30-Nov-14	0	4
35027	1	270	Dongola-North Sudan	24-Aug-15	2	1	5	Hydrocerton + Adrenaline + Antis	2	60	5	1	26-Aug-15	0	2
195	1	150	Dongola-North Sudan	29-May-15	2	1	1	SoftX + Cainola + Glucose	2	37	3	1	29-Jun-15	0	31
209	1	360	Dongola-North Sudan	24-Apr-14	2	1	2	Laxzy + Maxell + Espero	2	50	3.5		15-Jun-15	0	417

33246	1	11	Dongola-North Sudan	26-Aug-14	2	2	4	Fanco + Sftax + Dextrose	2		2.3	1	28-Aug-14	1	2
37066	2	60	Dongola-North Sudan	7-Dec-15	2	2	2	Samsung + fanko + laxcy	2		5	1	8-Dec-15	1	1
277	1	11	Dongola-North Sudan	6-Mar-14	2	2	4	Fanco + Sftax + Dextrose	2	35	2.3	1	10-Mar-14	1	4
297	1	50	Dongola-North Sudan	6-Jan-14	2	2	4	Fanco + Sftax + Dextrose	2	0	2.3	1	6-Feb-14	1	31
363	2	60	Dongola-North Sudan	7-Dec-15	2	2	3		2	30	2	1	8-Dec-15	1	1
39012	1	22	East Darfur	18-Aug-16	2	1	5	Samson + Dextrose	2		2.3	1	25-Aug-16	0	7
26935	1	2	El Azhari-Khartoum	27-Aug-12	2	1	4	SoftX + Empiclux	2	41	2.1	1	6-Sep-12	0	10
33565	2	1460	El Damer-River Nile	13-Oct-14	2	1	1	Seftrax + Laxxy + Dextrose + Samson	2	102	3.2	1	23-Oct-14	0	10
37485	1	90	El Damer-River Nile	28-Jan-16	2	1	2	Laxex + Maxil + Ventolin	2	46	2.8	1	6-Feb-16	0	9
36124	1	120	El Damer-River Nile	10-Aug-15	2	1	2	Penicillin + laxix + gentamicin	2		5	1	16-Aug-15	0	6
38756	2	23	El Damer-River Nile	28-Jul-16	2	1	4	SoftX + Fanco	2		3.7	1	29-Jul-16	0	1
33576	1	4	El Damer-River Nile	14-Oct-14	2	1	4	SoftX + Fanco	2		3	1	8-Nov-14	0	25
207	2	1460	El Damer-River Nile	13-Oct-12	2	1	1	Seftrax + Laxxy + Dextrose + Samson	2	102	15	1	23-Apr-13	0	192
215	2	3	El Deum Elshargia-Khartoum	26-Mar-16	2	1	4	Sftax + Vancomycin	2	40	2	1	31-Mar-16	1	5
320	2	21	El Deum Elshargia-Khartoum	1-Feb-13	2	2	4	Fanco	2	39	1	1	17-Feb-13	1	16
322	1	3	El Deum Elshargia-Khartoum	3-Feb-13	2	2	4	SoftX + Fanco	2	0	0	1	19-Feb-13	1	16
331	1	6	El Deum Elshargia-Khartoum	6-Oct-13	2	2	4	Fanko + SoftX	2	43	2.2	1	5-Nov-13	1	30
332	1	3	El Deum Elshargia-Khartoum	7-Oct-13	2	1	4	SoftX	2	0	2.6	1	12-Nov-13	1	36
37749	1	30	El Fasher-North Dafur	1-Mar-16	2	1	1		2	21	3	1	13-Mar-16	0	12
33523	1	210	El Fasher-North Dafur	5-Oct-14	2	1	1	Breast milk + Formella milk	2	71	6.5	1	10-Oct-14	0	5
37710	2	1815	El Fasher-North Dafur	27-Feb-16	2	1	1	Lazzy + zinc + folic acid	2	140	23	1	8-Mar-16	0	10
38214	1	1820	El Fasher-North Dafur	26-Apr-14	2	1	5	Samaxon + Pilgrim + Dextrose	2	89	15	2	5-Sep-16	0	863
121	2	1460	El Fasher-North Dafur	26-Apr-12	2	1	5	Samaxon + Pilgrim + Dextrose	2	89	15	2	20-Nov-14	0	938
190	1	420	El Fasher-North Dafur	1-Mar-16	2	1	1		2	40	3.5	1	13-Mar-16	0	12
197	1	370	El Fasher-North Dafur	5-Oct-14	2	1	1	Breast milk + Formella milk	2	35	2.5	1	10-Nov-14	0	36
32752	1	450	El Fasher-North Dafur	2-Jun-14	2	1	2	Saffron drink + laxi + penicillin	2	63	3	1	9-Jun-14	0	7
38149	1	150	El Fasher-North Dafur	18-Apr-16	2	1	2	Fanco + laxi + gentamicin + flagen	2	63	6.2	2	16-May-16	0	28

36243	2	1820	El Fasher-North Dafur	25-Aug-15	2	2	1	Laxi + nifedine + kenin	2		28	1	7-Sep-15	1	13
24588	2	7	El Gedida Al Thora-El Gezira	1-May-12	2	1	4	SoftX + Empiclux	2	49	3.6	1	6-May-12	0	5
36402	2	1810	El Geneina - West Darfur	10-Sep-15	2	2	1	Flagen + Dextrose + Samson + Fur	2			1	5-Oct-15	0	25
33794	2	1820	El Geneina - West Darfur	10-Nov-14	2	1	1	SoftX + Kinin + Caenola + Vitamin	2		27.5	1	16-Nov-14	0	6
32314	2	30	El Geneina - West Darfur	6-Apr-14	2	1	2	Laxzy + Maxell + Espero	2	66	6.5	2	2-Jun-14	0	57
31293	2	1800	El Gezira Aba-White Nile	23-Sep-13	2	1	5	Sftax + Fanco + Vitamin K	2	128	20	1	13-Oct-13	0	20
35836	1	1810	El Gezira State	27-Jun-15	2	1	1	Calcium + Sftax + Vitamin C	2	143	33.5	1	2-Jul-15	0	5
32000	2	1820	El Gezira State	13-Feb-14	2	1	1	Canola + Sftrax + Fanco + Ventolin	2		24	4	24-May-16	0	831
31838	2	270	El Gezira State	5-Jan-13	2	2	2	Laxex + penicillin + food salt	2		4.5	1	6-Jan-13	0	1
33166	2	90	El Gezira State	14-Aug-14	2	1	2	Laxi + Zinc syrup	2		5	1	18-Aug-14	0	4
25578	1	90	El Gezira State	19-Jun-12	2	1	2	Laxix + SoftX + Fanco	2	50	4	1	27-Jun-12	0	8
34511	2	120	El Gezira State	3-Feb-15	2	2	2	Maxil + Pendulum + Lazyx + Ventolin	2	70	6.3	4	28-Jan-16	0	359
39233	1	120	El Gezira State	21-Sep-16	2	1	2	Softx + Dextrose	2		4	1	28-Sep-16	0	7
33774	1	180	El Gezira State	9-Nov-14	2	1	2	Laxi + zinc + oxygen	2	69	7	1	10-Nov-14	0	1
31681	1	1095	El Gezira State	27-Nov-13	2	1	2	Gentamicin + water penicillin + folic acid	2	88	10	2	3-Mar-14	0	96
29427	1	1095	El Gezira State	13-Feb-13	2	1	2	SoftX + LasXi + Samsung	2	82	9	3	12-Jun-14	0	484
32382	1	66	El Gezira State	13-Apr-14	2	1	2	Sphinx + Spruce + Laszky	2	56	3.3	1	21-Apr-14	0	8
36886	1	1816	El Gezira State	14-Nov-15	2	1	3	Seftrax + Dextrose + Canola + Samson	2	108	15	2	27-Dec-15	0	43
36632	1	1820	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2		23	1	21-Oct-15	0	8
30605	1	13	El Gezira State	20-Jun-13	2	1	4	Fanco + Sftax + Dextrose	2	40	4.6	1	1-Jul-13	0	11
32131	2	14	El Gezira State	12-Mar-14	2	1	4	Sftax + Fanco + Vitamin K	2	38	5	1	29-Mar-14	0	17
31286	1	15	El Gezira State	22-Jan-13	2	1	4	Fanko + SoftX	2	50	3.4	1	11-Oct-13	0	262
32767	2	17	El Gezira State	6-Jun-14	2	1	4	SoftX + Fanco	2		3	1	17-Jun-14	0	11
35684	2	17	El Gezira State	7-Jun-15	2	1	4	Fanko + SoftX	2		4.4	1	16-Jun-15	0	9
30568	1	17	El Gezira State	15-Jun-13	2	1	4	Fanko + SoftX	2	51	2.2	1	2-Jul-13	0	17
32647	1	1	El Gezira State	18-May-14	2	1	4	Softx + Fanco + Dextrose	2	43	2.3	1	7-Jun-14	0	20
35082	2	20	El Gezira State	29-Mar-15	2	1	4	Fanko + Flagl	2		3.5	1	11-Apr-15	0	13
31889	1	20	El Gezira State	21-Jan-14	2	1	4	Softx + Fanco + Dextrose	2	37	34	1	9-Feb-14	0	19

27145	1	20	El Gezira State	31-Aug-12	2	1	4	Samson + Gentamicin	2	50	3.3	1	23-Sep-12	0	23
30365	2	21	El Gezira State	21-May-13	2	1	4	Softx + Enco + Potassium + Calcium	2	44	2.2	1	3-Jun-13	0	13
35597	1	21	El Gezira State	28-May-15	2	1	4	Softx + Dextrose	2	42	2.4	1	7-Jun-15	0	10
30237	1	22	El Gezira State	4-May-13	2	1	4	Fanco + Calcium + Samson	2	37	2.7	1	7-May-13	0	3
26187	1	25	El Gezira State	14-Jul-12	2	1	4	SoftX + Empiclux	2		1.4	1	29-Jul-12	0	15
39625	1	26	El Gezira State	20-Nov-16	2	1	4	SoftX + Fanco	2		3.9	1	6-Dec-16	0	16
38656	1	26	El Gezira State	29-Jun-16	2	1	4	SoftX + Fanco	2		2.3	1	4-Jul-16	0	5
38781	1	28	El Gezira State	21-Jul-16	2	1	4	Softx + Fanco + Dextrose	2		3.4	1	7-Aug-16	0	17
34814	2	2	El Gezira State	28-Feb-15	2	1	4	SoftX + Fanco	2	33	2.6	1	17-Mar-15	0	17
29476	1	2	El Gezira State	15-Feb-13	2	1	4	Calcium + Empiclux + Fanco	2	51	3	1	26-Feb-13	0	11
26160	1	30	El Gezira State	14-Jul-12	2	1	4	SoftX + Fanco	2	36	1.2	1	18-Jul-12	0	4
34673	1	33	El Gezira State	20-Feb-15	2	1	4	SoftXIM + Empiclux	2		3.4	1	11-Mar-15	0	19
35592	1	33	El Gezira State	8-Jun-15	2	1	4	Fanco + Vitamin (K) + Dextrose	2	35		1	21-Jun-15	0	13
32635	1	3	El Gezira State	15-May-14	2	1	4	Fanko + SoftX + ampliclux	2		2.7	1	6-Jun-14	0	22
23815	1	3	El Gezira State	31-Mar-12	2	1	4	Samson + Technicians	2	47	2.9	1	12-Apr-12	0	12
22487	1	3	El Gezira State	28-Jan-12	2	1	4	Samson + Calcium	2	18	3.2	1	19-Feb-12	0	22
29525	1	3	El Gezira State	26-Feb-13	2	1	4	SoftX + Fanco	2	50	2.6	1	16-Mar-13	0	18
31229	2	40	El Gezira State	22-Sep-13	2	1	4	Fanco + Dextrose	2	48	2.3	1	16-Oct-13	0	24
34698	2	4	El Gezira State	24-Feb-15	2	1	4	Svitax + Vitamin K	2		1.3	1	9-Mar-15	0	13
30608	1	4	El Gezira State	13-Oct-13	2	1	4	Softx + Dextrose	2	47	2.1	1	14-Nov-13	0	32
30445	2	5	El Gezira State	29-May-13	2	1	4	Fanko + ampiclux	2	40	3	1	12-Jun-13	0	14
35078	2	5	El Gezira State	29-Mar-15	2	1	4	SoftX + Calcium	2		2.7	1	4-Apr-15	0	6
28832	1	5	El Gezira State	26-Dec-12	2	1	4	Ampiclox + Vitamin K	2	47	2.3	1	2-Jan-13	0	7
25750	2	6	El Gezira State	20-Jun-12	2	1	4	Vivation + Samson + Dextrose	2	43		1	2-Jul-12	0	12
26139	1	6	El Gezira State	9-Jul-12	2	1	4	Penicillin water + Gentamicin	2		2	1	16-Jul-12	0	7
34621	2	6	El Gezira State	16-Feb-15	2	1	4	Softx + Dextrose	2		3.4	1	19-Feb-15	0	3
36395	1	6	El Gezira State	12-Sep-15	2	1	4	Fanco + Sftax + Dextrose	2	49	3.2	1	15-Sep-15	0	3
30890	1	7	El Gezira State	30-Jul-13	2	1	4	Softx + Dextrose	2	42	3.2	1	6-Aug-13	0	7

31740	1	8	El Gezira State	7-Dec-13	2	1	4	Calcium + Caenola	2	56	4.6	1	28-Dec-13	0	21
34911	1	8	El Gezira State	17-Mar-15	2	1	4	SoftX + Fanco	2	41	3.3	1	18-Mar-15	0	1
25690	2	9	El Gezira State	5-Jun-12	2	1	4	Softx + Dextrose	2		2.5	1	28-Jun-12	0	23
26905	1	1	El Gezira State	25-Aug-12	2	1	4	Softx + Dextrose	2		1.3	1	2-Sep-12	0	8
13230	2	120	El Gezira State	16-Oct-14	2	1	5	Samson + Morphine	2		14	2	16-Jan-15	0	92
37085	2	120	El Gezira State	8-Dec-15	2	1	5	Samson + Dextrose	2		11	2	21-May-16	0	165
38329	2	365	El Gezira State	13-May-16	2	1	5	Cainola + Fanco + Ceftrax + Dextrose	2		8	2	8-Jun-16	0	26
37091	2	1817	El Gezira State	11-Dec-15	2	1	5	Samson + Dextrose	2		15	1	18-Dec-15	0	7
19482	1	12	El Gezira State	21-Sep-13	2	1	5	Fanco + laxi + Amexacin	2	81	4.5	2	24-Jan-15	0	490
32598	1	730	El Gezira State	12-May-14	2	1	5	Ventolin + Folic acid + Hydrochlorzone	2	62	8.5	3	21-Dec-14	0	223
43479	1	1820	El Gezira State	8-Mar-14	2	1	5	Samson + Dextro	2			2	9-Jun-14	0	93
30761	2	1815	El Gezira State	13-Jul-14	2	1	5	Dextrose + Sftax + Canola + Folic	2		14	4	18-Dec-14	0	158
30348	1	1816	El Gezira State	2-Dec-14	2	1	5	Sftrax + Dextrose + Provine + Folic	2	21	121	2	18-Jan-15	0	47
36048	2	1800	El Gezira State	20-Apr-15	2	1	5	Softx + Dextrose	2		12	1	21-Apr-15	0	1
37098	2	1800	El Gezira State	13-Dec-15	2	1	5	Samsung + morphine + pendulum	2		19	2	10-Feb-16	0	59
39566	2	1815	El Gezira State	11-Nov-16	2	1	5	Dextrose + Samson + Fanco	2		18	1	22-Nov-16	0	11
36344	2	1810	El Gezira State	6-Sep-15	2	1	5	Adrenaline + Hydroquercone + Canio	2		20	2	4-Oct-15	0	28
50163	2	1820	El Gezira State	21-Jul-15	2	1	5	Canola + penicillin + dextrose	2		22	3	18-Aug-15	0	28
35861	2	670	El Gezira State	7-Jun-15	2	1	1	Sftax + laxix + amprazole + penicillin	2	80	12.5	1	9-Jun-15	0	2
4	1	330	El Gezira State	19-Aug-15	2	1	5	Fanco + Faulk + Canola	2	34	2	1	21-Mar-16	0	215
5	1	330	El Gezira State	19-Aug-15	2	1	5	Samson + Proven	2	34	2	1	21-Mar-16	0	215
14	2	730	El Gezira State	8-Jan-15	2	1	5	Samson + Dextrose	2	35	3	2	21-Mar-16	0	438
19	1	365	El Gezira State	13-May-16	2	1	5	Cainola + Fanco + Ceftrax + Dextrose	2	45	3	2	31-Oct-16	0	171
22	2	1095	El Gezira State	24-Jun-14	2	1	5	Transferring red blood cells	2	95	13	1	31-Jan-16	0	586
24	2	730	El Gezira State	11-Oct-15	2	1	5	Vancomycin + Amicassin + Caenu	2	50	3	1	22-Mar-16	0	163
54	1	1815	El Gezira State	11-Dec-15	2	1	5	Samson + Dextrose	2	113	25	1	11-Dec-16	0	366
64	2	1095	El Gezira State	21-Sep-12	2	1	5	Fanco + laxi + Amexacin	2	81	4.5	2	21-Jun-15	0	1003
79	1	1095	El Gezira State	12-May-14	2	1	5	Ventolin + Folic acid + Hydrochlorzone	2	62	8.5	3	10-Jul-14	0	59

81	1	1460	El Gezira State	12-May-14	2	1	5	Ventolin + Folic acid + Hydrochlorzone	2	107	14.8	3	22-Jul-14	0	71
116	2	1820	El Gezira State	8-Mar-14	2	1	5	Samson + Dextro	2	113	25	2	15-Nov-14	0	252
133	2	365	El Gezira State	13-Jul-14	2	1	5	Dextrose + Sftax + Canola + Folic	2	34	2.5	4	18-Dec-14	0	158
147	1	1080	El Gezira State	14-Nov-12	2	1	3	Seftrax + Dextrose + Canola + Samson	2	95	13	2	22-Jan-13	0	69
155	1	1080	El Gezira State	13-Oct-12	2	1	3	Dextrose + Sftax + Canola	2	95	13	1	21-Jul-13	0	281
169	2	1805	El Gezira State	14-Nov-14	2	1	3	Seftrax + Dextrose + Canola + Samson	2	113	25	2	11-Jun-15	0	209
177	2	1820	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	21-Apr-16	0	191
178	1	1815	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	21-Apr-16	0	191
179	1	1815	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	21-Apr-16	0	191
180	1	1820	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	21-Apr-16	0	191
181	1	1820	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	21-Apr-16	0	191
182	2	120	El Gezira State	13-Jan-14	2	1	3	Dextrose + Sftax + Canola	2	35	3	1	21-May-14	0	128
183	1	60	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	32	2.6	1	21-Dec-15	0	69
184	1	30	El Gezira State	13-Oct-15	2	1	3	Dextrose + Sftax + Canola	2	30	2	1	21-Nov-15	0	39
185	1	1820	El Gezira State	3-Oct-14	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	11-Nov-15	0	404
186	1	180	El Gezira State	30-Oct-14	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	22-Nov-15	0	388
187	1	30	El Gezira State	3-Oct-16	2	1	3	Dextrose + Sftax + Canola	2	30	2	1	21-Oct-16	0	18
188	1	1810	El Gezira State	3-Oct-14	2	1	3	Dextrose + Sftax + Canola	2	113	25	1	11-Oct-14	0	8
189	2	270	El Gezira State	30-Oct-12	2	1	3	Dextrose + Sftax + Canola	2	37	2.3	1	22-Mar-13	0	143
34670	1	3	El Gezira State	20-Feb-15	2	1	4	SoftX	2		2.6	1	24-Feb-15	1	4
36815	1	4	El Gezira State	2-Nov-15	2	2	4	SoftX + Fanco	2	50	2.7	1	27-Dec-15	1	55
28947	1	6	El Gezira State	6-Jan-13	2	2	4	Fanko + SoftX	2	43	2.2	1	12-Jan-13	1	6
35761	1	27	El Gezira State	17-Jun-15	2	2	2	Cainola + Fanco + La Paz	2		2.1	1	29-Jun-15	1	12
35612	1	120	El Gezira State	31-May-15	2	2	2	Laxi + dextrose + samsung	2	62	5	1	15-Jun-15	1	15
35532	2	1440	El Gezira State	20-May-15	2	2	2	Sftrax + Fanco + Dextrose	2		1	2	24-May-15	1	4
34944	2	210	El Gezira State	12-Mar-15	2	2	2	Cainola + Sftrax + La Paz	2		3.7	2	14-May-15	1	63
211	1	9	El Gezira State	22-Mar-16	2	1	4	SoftX	2	40	3.5	1	31-Mar-16	1	9
225	1	3	El Gezira State	10-Dec-16	2	2	4	Fanco	2	34	2.2	1	15-Dec-16	1	5

230	1	28	El Gezira State	15-Dec-16	2	2	4	Fanko + SoftX	2	43	2.2	1	20-Dec-16	1	5
231	2	18	El Gezira State	2-Jun-14	2	1	4	SoftX	2	0	2.6	1	13-Jun-14	1	11
233	1	12	El Gezira State	10-Jun-14	2	1	4	Vancomycin + Formem	2	0	2.7	1	15-Jun-14	1	5
235	2	6	El Gezira State	20-Oct-14	2	2	4	Sftax + Vancomycin	2	34	5.8	1	29-Oct-14	1	9
238	1	15	El Gezira State	20-Oct-14	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	29-Oct-14	1	9
239	2	21	El Gezira State	1-May-16	2	2	4	Fanco	2	39	1	1	17-May-16	1	16
243	1	25	El Gezira State	5-May-16	2	2	4	SoftX + Fanco	2	50	2.7	1	21-May-16	1	16
251	1	3	El Gezira State	15-Nov-15	2	1	4	SoftX	2	33	2.6	1	24-Nov-15	1	9
253	1	20	El Gezira State	17-Nov-15	2	1	4	Vancomycin + Formem	2	30	2.7	1	26-Nov-15	1	9
254	2	1	El Gezira State	17-Nov-15	2	1	4	Vancomycin + SoftX	2	35	2.6	1	19-Nov-15	1	2
263	2	8	El Gezira State	11-Nov-14	2	2	4	SoftX + Fanco	2	50	2.7	1	15-Nov-14	1	4
265	2	24	El Gezira State	11-Oct-16	2	2	4	Fanco	2	34	2.2	1	15-Oct-16	1	4
270	1	6	El Gezira State	14-Oct-14	2	2	4	Fanko + SoftX	2	43	2.2	1	22-Oct-14	1	8
272	1	3	El Gezira State	1-Mar-14	2	1	4	SoftX	2	30	2.6	1	4-Mar-14	1	3
278	1	17	El Gezira State	1-Nov-14	2	2	4	Fanko + SoftX	2	43	1.3	1	17-Nov-14	1	16
295	1	120	El Gezira State	15-Jan-14	2	1	4	Vancomycin + SoftX	2	35	2.6	1	4-Feb-14	1	20
298	1	270	El Gezira State	2-Nov-12	2	2	4	Fanko + SoftX	2	43	1.3	1	17-Jan-13	1	76
299	1	90	El Gezira State	3-Jan-13	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	18-Jan-13	1	15
300	1	21	El Gezira State	4-Jan-13	2	2	4	Fanco	2	39	1	1	19-Jan-13	1	15
304	2	14	El Gezira State	8-Jan-13	2	2	4	SoftX + Fanco	2	50	2.7	1	13-Jan-13	1	5
311	2	90	El Gezira State	19-May-13	2	2	4	Fanko + SoftX	2	43	2.2	1	17-Jun-13	1	29
321	2	6	El Gezira State	10-Feb-13	2	2	4	Fanko + SoftX	2	37	1.2	1	18-Feb-13	1	8
323	2	16	El Gezira State	14-Feb-13	2	2	4	Flagell	2	0	1.3	1	20-Feb-13	1	6
346	2	480	El Gezira State	12-Dec-12	2	2	5	Sprou + Amaxil	2	35	3.2	1	16-Jan-13	1	35
349	2	480	El Gezira State	12-May-13	2	2	5	Sprou + Amaxil	2	33	2.8	1	16-May-13	1	4
352	1	480	El Gezira State	12-Sep-16	2	2	5	Sprou + Amaxil	2	0	56	1	16-Oct-16	1	34
355	2	480	El Gezira State	12-May-13	2	2	5	Sprou + Amaxil	2	0	2.6	1	16-May-13	1	4
364	1	27	El Gezira State	17-Nov-15	2	2	3		2	0	2.1	1	17-Dec-15	1	30

365	2	420	El Gezira State	30-Sep-15	2	2	3		2	62	5	1	15-Dec-15	1	76
368	2	1440	El Gezira State	20-May-13	2	2	3		2	65	9	2	24-May-13	1	4
373	2	210	El Gezira State	12-Mar-15	2	2	3		2	35	3.7	2	14-May-15	1	63
386	1	270	El Gezira State	31-May-15	2	2	2	Laxi + dextrose + samsung	2	40	3	1	15-Jun-15	1	15
36135	1	1817	El Shajara-Khartoum	12-Aug-15	2	1	1	Samson + Glucks + Furtam	2		15.3	1	19-Aug-15	0	7
38312	2	2	El Shajara-Khartoum	10-May-16	2	1	4	SoftX	2		3.2	1	16-May-16	0	6
31453	2	2	El Shajara-Khartoum	22-Oct-13	2	1	4	SoftX + Fanco + Cainola	2	51	2.9	1	27-Oct-13	0	5
38864	2	3	El Shajara-Khartoum	1-Aug-16	2	1	4	Softax + Fanko + Fortem	2		3.2	1	31-Aug-16	0	30
35080	1	4	El Shajara-Khartoum	29-Mar-15	2	1	4	SoftX + Fanco	2	52	3	1	4-May-15	0	36
35175	2	4	El Shajara-Khartoum	7-Apr-15	2	1	4	Softx + Dextrose	2		3.4	1	11-Apr-15	0	4
26969	2	4	El Shajara-Khartoum	27-Aug-12	2	1	4	SoftX + Fanco	2	37	2.4	1	5-Sep-12	0	9
31201	2	6	El Shajara-Khartoum	25-Jun-12	2	1	4	Fanco + Sftax + Dextrose	2	37	3.5	1	29-Sep-13	0	461
6	1	360	El Shajara-Khartoum	7-Aug-15	2	2	5	Dextrose + Canapula + Samson	2	34	2	1	21-Mar-16	0	227
7	1	360	El Shajara-Khartoum	7-Aug-15	2	1	5	Samson + Fanko + Provin	2	34	2	2	21-Mar-16	0	227
8	1	450	El Shajara-Khartoum	29-Dec-15	2	2	5	Sftrexone + Vancomycin	2	84	3	1	21-Mar-16	0	83
9	1	450	El Shajara-Khartoum	25-Aug-15	2	1	5	Dextrose + Caenola + Sftax + Pendulum	2	84	3	1	21-Mar-16	0	209
212	1	2	El Shajara-Khartoum	23-Mar-16	2	1	4	Calcium	2	40	2	1	31-Mar-16	1	8
226	1	16	El Shajara-Khartoum	11-Dec-16	2	2	4	Fanko + SoftX	2	41	3	1	16-Dec-16	1	5
250	1	11	El Shajara-Khartoum	1-Dec-15	2	2	4	Fanko + SoftX	2	43	2.2	1	11-Dec-15	1	10
266	1	17	El Shajara-Khartoum	11-Oct-16	2	2	4	Fanko + SoftX	2	41	1.6	1	16-Oct-16	1	5
268	2	1	El Shajara-Khartoum	2-Oct-14	2	2	4	SoftX + Fanco	2	30	1.6	1	20-Oct-14	1	18
274	1	20	El Shajara-Khartoum	3-Mar-14	2	1	4	Vancomycin + Formem	2	35	2.7	1	16-Mar-14	1	13
281	2	730	El Shajara-Khartoum	2-May-14	2	2	4	Fanko + SoftX	2	58	4.5	1	17-Jul-14	1	76
301	1	60	El Shajara-Khartoum	5-Jan-13	2	2	4	Fanko + SoftX	2	37	1.2	1	30-Jan-13	1	25
310	2	100	El Shajara-Khartoum	30-May-13	2	2	4	SoftX + Fanco	2	37	3	1	16-Jun-13	1	17
330	1	11	El Shajara-Khartoum	2-Oct-13	2	2	4	SoftX + Fanco	2	37	1	1	3-Nov-13	1	32
39353	2	3	FAO-Gadaref	4-Oct-16	2	1	4	SoftX + Fanco + Cainola	2		3	1	9-Oct-16	0	5
22830	2	1800	Gadaref-East Sudan	11-Feb-12	2	1	1	Laxix + Ventolin + Calcium	2		50	1	24-Feb-12	0	13

16318	2	1820	Gadaref-East Sudan	9-May-12	2	2	3	Dextrose + salt	2		21	2	15-Jun-12	0	37
34352	2	1816	Gadaref-East Sudan	16-Jan-15	2	1	3	Vanko + Provin + Siftax + Vortem	2		34	1	24-Jan-15	0	8
32460	2	11	Gadaref-East Sudan	21-Apr-14	2	1	4	Empixlux + SoftX + Professional	2	48	3.3	1	6-May-14	0	15
37912	1	31	Gadaref-East Sudan	21-Mar-16	2	1	4	SoftX + Fanco + Lazixi	2		3	1	3-Apr-16	0	13
35003	1	9	Gadaref-East Sudan	19-Mar-15	2	1	4	Flagen + Sftax + Calcium	2	47	3.1	1	12-Apr-15	0	24
35229	2	13	Gadaref-East Sudan	5-Apr-15	2	1	5	Opsnine + Zinc + Hydex	2	86	10	1	15-Apr-15	0	10
37810	2	365	Gadaref-East Sudan	9-Mar-16	2	1	5	Samson + Kenin	2		7.5	1	12-Mar-16	0	3
37113	1	730	Gadaref-East Sudan	14-Dec-15	2	1	5	Samson + penicillin water	2		10	1	16-Dec-15	0	2
36759	2	1820	Gadaref-East Sudan	27-Oct-15	2	1	5	Hydercerton + Samson	2		16	1	28-Oct-15	0	1
32472	2	1800	Gadaref-East Sudan	24-Apr-14	2	1	5	Samson + Dextrose	2			2	18-Mar-15	0	328
65	2	1460	Gadaref-East Sudan	15-Apr-15	2	1	5	Opsnine + Zinc + Hydex	2	86	10	1	28-Jun-15	0	74
71	1	1095	Gadaref-East Sudan	9-Mar-14	2	1	5	Samson + Kenin	2	95	13	1	28-Jun-15	0	476
88	1	365	Gadaref-East Sudan	14-Jan-14	2	1	5	Samson + penicillin water	2	35	2	1	7-Oct-14	0	266
120	2	1460	Gadaref-East Sudan	27-Oct-12	2	1	5	Hydercerton + Samson	2	104	14.8	1	15-Nov-14	0	749
136	2	1820	Gadaref-East Sudan	9-Oct-16	2	2	3	Dextrose + salt	2	113	25	2	15-Nov-16	0	37
152	2	1080	Gadaref-East Sudan	16-Jan-15	2	1	3	Vanko + Provin + Siftax + Vortem	2	95	13	1	24-Jan-15	0	8
158	2	1095	Gadaref-East Sudan	9-May-13	2	2	3	Dextrose + salt	2	100	14	2	30-Jun-13	0	52
174	1	730	Gadaref-East Sudan	16-Jan-16	2	1	3	Vanko + Provin + Siftax + Vortem	2	50	3	1	3-Oct-16	0	261
20853	1	1460	Haj Yousef-Khartoum	9-Aug-15	2	1	1	Dextrose + canola + sodium	2	87	11.5	3	24-Nov-15	0	107
20853	1	1815	Haj Yousef-Khartoum	9-Aug-15	2	1	1	Calcium + sodium	2		11	3	24-Nov-15	0	107
33236	2	60	Haj Yousef-Khartoum	25-Aug-14	2	1	2	Lactose + Dactone + Sascon + Ventolin	2		7	1	1-Sep-14	0	7
33676	2	660	Haj Yousef-Khartoum	26-Oct-14	2	1	2	SoftX + Ventolin + LASXI	2		6	1	28-Oct-14	0	2
33533	1	150	Haj Yousef-Khartoum	15-Feb-14	2	1	2	Laxix + Mucil + Ventolin	2		3.2	2	29-Jan-15	0	348
33171	1	365	Haj Yousef-Khartoum	14-Aug-14	2	1	2	Fanko + Samson + Laxzy	2		6.4	1	20-Aug-14	0	6
38190	2	730	Haj Yousef-Khartoum	23-Apr-16	2	1	2	Laxxy + SoftX	2		8	1	27-Apr-16	0	4
32868	1	540	Haj Yousef-Khartoum	8-Jun-14	2	1	2	Maxil + pendulum syrup + laxi	2		7	1	29-Jun-14	0	21
39631	2	32	Haj Yousef-Khartoum	19-Nov-16	2	1	2	Sftaki + laxi + fanco	2		3.5	1	3-Dec-16	0	14
34117	1	730	Haj Yousef-Khartoum	18-Dec-14	2	1	3	Vortem + Vancomycin + pendulum syrup	2		11	1	19-Dec-14	0	1

38077	1	11	Haj Yousef-Khartoum	10-Apr-16	2	1	4	Fanko + SoftX	2		2.7	1	21-Apr-16	0	11
26359	2	11	Haj Yousef-Khartoum	23-Jul-12	2	1	4	SoftX + Empiclux	2		3.8	1	28-Jul-12	0	5
35386	2	12	Haj Yousef-Khartoum	14-May-15	2	1	4	Softx + Dextrose	2	53	2.6	1	3-Jun-15	0	20
24536	1	14	Haj Yousef-Khartoum	29-Apr-12	2	1	4	Softx + Calcium + Fanco	2	37	1.4	1	5-Jun-12	0	37
38621	1	1	Haj Yousef-Khartoum	22-Jun-16	2	1	4	Samsung + zinc	2		2.6	1	18-Jul-16	0	26
31239	2	24	Haj Yousef-Khartoum	7-Feb-13	2	1	4	Ampiclox + Vitamin B	2	46	3	1	28-Feb-13	0	21
34240	2	29	Haj Yousef-Khartoum	2-Jan-15	2	1	4	Svitax + Vitamin D	2	40	1.2	1	31-Jan-15	0	29
27614	1	2	Haj Yousef-Khartoum	30-Sep-12	2	1	4	Softx + Dextrose	2	48	2.7	1	11-Oct-12	0	11
24229	1	3	Haj Yousef-Khartoum	14-Apr-12	2	1	4	SoftX + Calcium	2	48	3	1	22-Apr-12	0	8
35602	1	3	Haj Yousef-Khartoum	28-May-15	2	1	4	Epiclux + Sftax + Vitamin K	2	44	2.2	1	7-Jun-15	0	10
27610	1	7	Haj Yousef-Khartoum	29-Sep-12	2	1	4	Fanko + SoftX	2	48	2.5	1	30-Sep-12	0	1
25801	2	8	Haj Yousef-Khartoum	24-Jun-12	2	1	4	Softx + Dextrose	2		2.4	1	7-Jul-12	0	13
36668	1	730	Haj Yousef-Khartoum	18-Oct-15	2	1	5	SoftX + Cainola	2		11.2	1	21-Oct-15	0	3
35781	2	1800	Haj Yousef-Khartoum	22-Sep-15	2	2	5	Samsung + pendulum	2		20	2	18-Nov-15	0	57
38906	1	1820	Haj Yousef-Khartoum	7-Aug-16	2	1	5	Morphine + Dextrose + Fanco	2		26	1	28-Aug-16	0	21
38488	1	365	Haj Yousef-Khartoum	2-Jun-16	2	2	5	Canola + Softrax + Zinc Syrup	2	79	7	1	9-Jun-16	0	7
36484	1	600	Haj Yousef-Khartoum	21-Sep-15	2	1	5	Samsung + sftax + pendulum	2	76	9	1	27-Sep-15	0	6
35580	1	730	Haj Yousef-Khartoum	27-May-15	2	1	5	SoftX + Zinc + Samsung	2		11	2	28-Sep-15	0	124
38829	1	1820	Haj Yousef-Khartoum	27-Jul-16	2	1	5	Samson + Dextroz	2		13.5	1	5-Aug-16	0	9
37622	1	1820	Haj Yousef-Khartoum	13-Feb-16	2	1	5	Dextrose + Morphine + Caenola + Samson	2			1	24-Feb-16	0	11
32755	1	210	Haj Yousef-Khartoum	2-Jun-14	2	1	5	Samson + Fanco + Fantolin	2	62	4	1	17-Jun-14	0	15
35295	2	1820	Haj Yousef-Khartoum	23-Apr-14	2	1	5	Samson + Canola	2		24	1	30-Apr-14	0	7
2	2	1095	Haj Yousef-Khartoum	1-Jan-12	2	1	5	Samson + Canola	2	95	13	1	31-Dec-14	0	1095
26	2	730	Haj Yousef-Khartoum	18-Oct-15	2	1	5	SoftX + Cainola	2	50	3	1	30-Mar-16	0	164
58	2	1820	Haj Yousef-Khartoum	22-Sep-15	2	2	5	Samsung + pendulum	2	113	25	2	27-Dec-16	0	462
61	2	1820	Haj Yousef-Khartoum	7-Aug-12	2	1	5	Morphine + Dextrose + Fanco	2	113	26	1	28-Jun-15	0	1055
68	1	730	Haj Yousef-Khartoum	2-Jun-14	2	2	5	Canola + Softrax + Zinc Syrup	2	60	2	1	28-Jun-15	0	391
73	1	60	Haj Yousef-Khartoum	21-Jun-15	2	1	5	Samsung + sftax + pendulum	2	32	2	1	29-Jun-15	0	8

89	1	730	Haj Yousef-Khartoum	27-May-14	2	1	5	SoftX + Zinc + Samsung	2	50	3	2	7-Oct-14	0	133
118	2	1820	Haj Yousef-Khartoum	27-Jul-12	2	1	5	Samson + Dextroz	2	113	25	1	15-Nov-14	0	841
124	1	1095	Haj Yousef-Khartoum	13-Feb-12	2	1	5	Dextrose + Morphine + Caenola + Samson	2	95	13	1	9-Feb-14	0	727
132	1	210	Haj Yousef-Khartoum	2-Jun-14	2	1	5	Samson + Fanco + Fantolin	2	35	2.4	1	17-Jun-14	0	15
142	2	730	Haj Yousef-Khartoum	18-Dec-13	2	1	3	Vortem + Vancomycin + pendulum syrup	2	50	3.2	1	19-Mar-14	0	91
164	1	730	Haj Yousef-Khartoum	18-Jun-15	2	1	3	Vortem + Vancomycin + pendulum syrup	2	50	3.2	1	16-Mar-16	0	272
38294	2	480	Haj Yousef-Khartoum	9-May-16	2	2	5	Sprou + Amaxil	2		56	1	16-May-16	1	7
36664	2	55	Haj Yousef-Khartoum	14-Oct-15	2	2	2	Maxil + laxi + dextrose + canola	2	50	3.6	2	17-Dec-15	1	64
35086	1	90	Haj Yousef-Khartoum	29-Mar-15	2	2	2	Lazzy + canola + fanco	2	46	3.1	2	5-May-15	1	37
34924	1	1820	Haj Yousef-Khartoum	10-Mar-15	2	2	1	Fanco + laxi + dextrose	2	155	36	1	11-Mar-15	1	1
32183	2	600	Haj Yousef-Khartoum	19-Mar-14	2	2	1	Laxix + Embrazol + Nefidine	2	8	9	1	2-Apr-14	1	14
358	1	480	Haj Yousef-Khartoum	9-Nov-16	2	2	3		2	36	2.7	1	16-Nov-16	1	7
367	2	55	Haj Yousef-Khartoum	14-Jun-14	2	2	3		2	30	2	2	17-Jun-14	1	3
369	1	90	Haj Yousef-Khartoum	29-Jul-13	2	2	3		2	30	2.8	2	5-Aug-13	1	7
384	1	90	Haj Yousef-Khartoum	10-Mar-13	2	2	1	Fanco + laxi + dextrose	2	35	2.5	1	11-Mar-13	1	1
34857	1	60	Halfa-North Sudan	4-Mar-15	2	1	1	Dextrose + laxix + fanco + sftax	2	50	3	1	26-Mar-15	0	22
38249	1	25	Halfa-North Sudan	2-May-16	2	1	2	Laxxy + SoftX	2	61	4	1	4-May-16	0	2
46159	1	1815	Halfa-North Sudan	16-Aug-15	2	1	3	Seftrax + Samaxon + Dextrose + Canola	2		13	1	21-Aug-15	0	5
33344	2	15	Halfa-North Sudan	9-Sep-14	2	1	4	Fanko + SoftX	2	52	3.5	1	9-Dec-14	0	91
146	1	1820	Halfa-North Sudan	16-Aug-12	2	1	3	Seftrax + Samaxon + Dextrose + Canola	2	113	25	1	12-Jan-13	0	149
168	1	1800	Halfa-North Sudan	16-Aug-14	2	1	3	Seftrax + Samaxon + Dextrose + Canola	2	113	25	1	15-Jun-15	0	303
193	1	60	Halfa-North Sudan	4-Mar-15	2	1	1	Dextrose + laxix + fanco + sftax	2	30	1.8	1	4-Jun-15	0	92
38075	1	240	Halfa-North Sudan	10-Apr-16	2	1	2	Sftax + Dopamine + Vancomycin	2	57	6.3	1	25-Apr-16	1	15
39143	2	1817	Halfa-North Sudan	6-Sep-16	2	2	1	Laxi + dextrose + samsung	2	116	17	1	6-Oct-16	1	30
381	2	720	Halfa-North Sudan	6-Apr-13	2	2	1	Laxi + dextrose + samsung	2	58	4.5	1	24-Jun-13	1	79
32668	2	1	Jabal Awlia-Khartoum	21-May-14	2	2	4	SoftX + Fanco	2		1.6	1	31-May-14	1	10
37142	2	90	Jabal Awlia-Khartoum	16-Dec-15	2	2	2	Laxzy + Fanko + Samson	2		2.5	1	23-Dec-15	1	7
34578	1	1650	Jabal Awlia-Khartoum	2-Mar-15	2	2	2	Laxzi + Formem + Canola + Fanco	2		4.5	2	7-Mar-15	1	5

228	1	18	Jabal Awlia-Khartoum	13-Dec-16	2	2	4	SoftX + Fanco	2	40	2.6	1	18-Dec-16	1	5
248	1	20	Jabal Awlia-Khartoum	20-Nov-15	2	2	4	SoftX + Fanco	2	0	1.6	1	9-Dec-15	1	19
309	1	377	Jabal Awlia-Khartoum	17-May-13	2	2	4	SoftX + Fanco	2	41	3.6	1	15-Jun-13	1	29
329	2	1	Jabal Awlia-Khartoum	7-Apr-13	2	2	4	SoftX + Fanco	2	0	1.6	1	30-Apr-13	1	23
361	2	420	Jabal Awlia-Khartoum	16-Dec-15	2	2	3		2	0	2.5	1	23-Apr-16	1	129
366	1	1650	Jabal Awlia-Khartoum	2-Mar-15	2	2	3		2	58	4.5	2	7-Jun-15	1	97
38925	1	1460	Jabal Awlia-Khartoum	9-Aug-16	2	1	1	Doctor + Canola	2		11	1	15-Aug-16	0	6
33161	2	420	Jabal Awlia-Khartoum	12-Aug-14	2	1	2	Saffron syrup + laxi	2		4	1	18-Aug-14	0	6
37914	2	270	Jabal Awlia-Khartoum	22-Mar-16	2	1	2	Laxix + Fanco + Ventolin	2	72	5.5	1	29-Mar-16	0	7
38863	2	14	Jabal Awlia-Khartoum	28-Jul-16	2	1	4	Softx + Fanco + Dextrose	2		2.8	1	4-Aug-16	0	7
38276	1	24	Jabal Awlia-Khartoum	9-May-16	2	1	4		2	50	2.7	1	21-May-16	0	12
38275	1	24	Jabal Awlia-Khartoum	27-Apr-16	2	1	4	SoftX + Cainola	2	50	2.3	1	21-May-16	0	24
31828	1	33	Jabal Awlia-Khartoum	19-Dec-13	2	1	4	SPECTAX + FLAGEL + Vitamin K	2	39	1.2	1	22-Jan-14	0	34
22338	2	5	Jabal Awlia-Khartoum	22-Jan-12	2	1	4	Samsung + sftax	2	50	3.3	1	25-Jan-12	0	3
28895	1	1	Jabal Awlia-Khartoum	2-Jan-13	2	1	4	Softx + Dextrose	2		5.4	1	7-Feb-13	0	36
28544	1	1	Jabal Awlia-Khartoum	20-Jun-12	2	1	4	SoftX + Fanco	2		4.8	1	14-Dec-12	0	177
39997	1	90	Jabal Awlia-Khartoum	8-Mar-15	2	1	5	Samson + Dextrose	2			1	12-Jan-16	0	310
775	2	1460	Jabal Awlia-Khartoum	11-Feb-15	2	1	5	Cainola + Fanco + Dextrose + Sftax	2		15	3	10-Nov-16	0	638
20559	1	1820	Jabal Awlia-Khartoum	3-May-15	2	1	5	Dextrose + Softrax	2		17.5	2	13-Jun-15	0	41
40	1	1460	Jabal Awlia-Khartoum	11-Feb-13	2	1	5	Cainola + Fanco + Dextrose + Sftax	2	104	14	3	30-Nov-16	0	1388
126	2	730	Jabal Awlia-Khartoum	3-Feb-14	2	1	5	Dextrose + Softrax	2	44	3.3	2	20-May-14	0	106
205	1	365	Jabal Awlia-Khartoum	9-Feb-13	2	1	1	Doctor + Canola	2	35	2	1	15-Feb-13	0	6
208	1	730	Jabal Awlia-Khartoum	9-Apr-13	2	1	1	Doctor + Canola	2	50	6	1	15-Apr-13	0	6
32115	1	16	Jabra-Khartoum	10-Mar-14	2	1	4	Fanko + SoftX	2	50	3	1	17-Mar-14	0	7
22755	2	1	Jabra-Khartoum	11-Feb-12	2	1	4	Water penicillin + dextrose	2		3	1	22-Feb-12	0	11
34883	1	2	Jabra-Khartoum	6-Mar-15	2	1	4	SoftX + Fanco	2	51	3.5	1	19-Jun-15	0	105
35221	1	5	Jabra-Khartoum	15-Apr-15	2	1	4	Dextrose + SoftX	2	52	3.1	1	21-Apr-15	0	6
39225	2	6	Jabra-Khartoum	21-Sep-16	2	1	4	SoftX + Fanco	2		2.7	1	26-Sep-16	0	5

30471	1	9	Jabra-Khartoum	5-Jun-13	2	1	4	SoftX + Fanco	2	45	2	1	12-Jun-13	0	7
32196	2	330	Jabra-Khartoum	19-Mar-14	2	1	5	Fanco + Faulk + Canola	2		20	1	21-Mar-14	0	2
37288	1	360	Jabra-Khartoum	7-Jan-16	2	2	5	Dextrose + Canapula + Samson	2		6.4	1	11-Jan-16	0	4
37257	2	1815	Jabra-Khartoum	5-Jan-16	2	1	5	Sftraxone + Fantolin + Dextrose	2		15.5	1	13-Jan-16	0	8
37257	2	1820	Jabra-Khartoum	5-Jan-16	2	1	5	Ventolin + Samson	2			1	14-Jan-16	0	9
14902	1	1800	Jabra-Khartoum	16-Nov-14	2	1	5	Samsung + laxi + dextrose	2		18	2	20-Feb-15	0	96
45	2	1815	Jabra-Khartoum	5-Jan-16	2	1	5	Sftraxone + Fantolin + Dextrose	2	113	25	1	21-Dec-16	0	351
112	1	1820	Jabra-Khartoum	5-Jan-13	2	1	5	Ventolin + Samson	2	113	25	1	18-Nov-14	0	682
33878	2	1805	Kadugli-Kurdofan	17-Nov-14	2	1	1	Embrazole + Canola	2	124	17.5	1	19-Nov-14	0	2
61090	2	1810	Kadugli-Kurdofan	5-Mar-13	2	1	5	Samson + Dextrose	2	121	19	2	6-Jul-13	0	123
29591	1	1460	Kadugli-Kurdofan	4-Mar-13	2	1	5	Maxil + Dextrose	2		14	1	7-Mar-13	0	3
55	1	1816	Kadugli-Kurdofan	5-Mar-13	2	1	5	Samson + Dextrose	2	113	25	2	5-Dec-16	0	1371
101	1	210	Kadugli-Kurdofan	4-Mar-14	2	1	5	Maxil + Dextrose	2	50	3	1	17-Nov-14	0	258
26339	2	5	Kamlin-El Gezira	21-Jul-12	2	1	4	SoftX + Fanco	2		2.3	1	1-Aug-12	0	11
29614	1	5	Kamlin-El Gezira	5-Mar-13	2	1	4	SoftX + Fanco	2		3	1	17-Mar-13	0	12
26325	2	20	Kamlin-El Gezira	21-Jul-12	2	1	4	Softx + Dextrose	2	38	1	1	30-Aug-12	0	40
31265	1	18	Karima-North Sudan	18-Sep-13	2	1	4	Softx + Fanco + Dextrose	2	48	2.7	1	25-Sep-13	0	7
23439	1	23	Karima-North Sudan	13-Feb-12	2	1	4	Softx + Dextrose	2		1.9	1	20-Mar-12	0	36
38461	1	1460	Kassala-East Sudan	30-May-16	2	1	1	Embrazole + Canola + La Paz	2		18	1	25-Jun-16	0	26
32528	2	365	Kassala-East Sudan	30-Apr-14	2	1	2	Lazky + Sftax + Folic	2	57	3	2	29-Sep-14	0	152
34573	1	13	Kassala-East Sudan	10-Feb-15	2	1	4	SoftX + Fanco	2		4.6	1	23-Feb-15	0	13
34910	2	3	Kassala-East Sudan	9-Mar-15	2	1	4	Fanko + SoftX	2	46	2.5	1	21-Mar-15	0	12
37190	1	330	Kassala-East Sudan	24-Dec-15	2	1	5	Samson + Proven	2		8.4	1	28-Dec-15	0	4
32202	2	150	Kassala-East Sudan	23-Mar-14	2	2	2	Laxxy + Sycamax + Canola	2	51	4.2	2	29-Apr-14	1	37
370	2	420	Kassala-East Sudan	23-Aug-13	2	2	3		2	37	3	2	29-Aug-13	1	6
387	2	730	Kassala-East Sudan	23-Mar-14	2	2	2	Laxxy + Sycamax + Canola	2	60	4.2	2	29-Jun-15	1	463
27784	2	26	Khartoum	8-Oct-12	2	1	4	SoftX + EmpixLux + WinTwin	2	50	3.6	1	10-Nov-13	0	398
24732	1	2	Khartoum	7-May-12	2	1	4	Vitamin K - Softox + Dextrose	2	35	4	1	6-Jun-12	0	30

38779	2	3	Khartoum	21-Jul-16	2	1	4	SoftX + Fanco	2	49	3.7	1	4-Aug-16	0	14
34959	2	7	Khartoum	16-Mar-15	2	1	4	SoftX + Fanco	2	54	2.7	1	22-Mar-15	0	6
35527	1	9	Khartoum	19-May-15	2	1	4	SoftX + Fanco	2		3.5	1	24-May-15	0	5
34284	2	1820	Khartoum	8-Jan-15	2	2	1	Itnallol + Nefidine + Embrazole	2	147	38	1	22-Jan-15	1	14
32634	2	9	Khartoum3	6-Jun-14	2	1	4	Empixlux + Fanko + SoftX	2	46	2.3	1	26-Jun-14	0	20
27593	1	540	Kinana-While Nile	14-Oct-12	2	1	2	Maxell + Lazyxie	2	77	7	1	21-Oct-12	0	7
36336	2	1820	Kosti-While Nile	5-Sep-15	2	1	1	Sftrax + Sodium + Fanco + Samson	2	100	11	1	15-Sep-15	0	10
32478	1	10	Kosti-While Nile	26-Apr-14	2	1	4	SoftX + Fanco	2	54	3.5	1	30-Apr-14	0	4
33124	2	2	Kosti-While Nile	7-Aug-14	2	1	4	Fanco + Sftax + Dextrose	2		2.5	1	22-Aug-14	0	15
35485	2	31	Kosti-While Nile	13-May-15	2	1	4	Fanco + Flags + Vitamin K	2		3.1	1	29-May-15	0	16
24331	2	6	Kosti-While Nile	19-Apr-12	2	1	4	Sftax + Fanco + Vitamin K	2	45	2.4	1	16-May-12	0	27
37371	1	240	Kosti-While Nile	17-Jan-16	2	1	5	Maxil + Ventolin + Dextrose	2		6.5	1	20-Jan-16	0	3
24374	2	1460	Kosti-While Nile	22-Apr-12	2	1	5	Samsung + laxi + fantolin	2		21	3	27-Dec-16	0	1710
38284	1	1800	Kosti-While Nile	9-May-16	2	1	5	Samson + Dextrose	2	100	20	2	10-Aug-16	0	93
44	1	1460	Kosti-While Nile	22-Apr-12	2	1	5	Samsung + laxi + fantolin	2	104	14	3	27-Dec-16	0	1710
60	2	1800	Kosti-While Nile	9-May-16	2	1	5	Samson + Dextrose	2	113	25	2	27-Dec-16	0	232
36227	2	1815	Kurdofan	24-Aug-15	2	1	1	Samson + Vitamine (K)	2	135	33	1	3-Sep-15	0	10
39052	2	1816	Kurdofan	15-Dec-16	2	1	1	Laxix + nitroline + nifedine + dextrose	2	135	25	1	27-Dec-16	0	12
36662	2	120	Kurdofan	17-Oct-15	2	1	2	Laxacy + vancomycin	2		4	2	26-Oct-15	0	9
31565	1	330	Kurdofan	11-Nov-13	2	1	2	Penicillin + gentamicin	2		11	1	12-Nov-15	0	731
31565	1	540	Kurdofan	11-Nov-13	2	1	2	Gentamicin + penicillin	2		11	1	12-Nov-13	0	1
34601	2	210	Kurdofan	14-Feb-15	2	1	2	Laxacy + Maxil + Oxygen	2	55	4	1	19-Feb-15	0	5
39179	2	10	Kurdofan	11-Sep-16	2	1	3	Dextrose + Sftrax + Fanco + Hydrochlorzone	2			1	20-Sep-16	0	9
38429	2	1095	Kurdofan	26-May-16	2	1	3	Dextrose + Adrenaline + Sftrax	2	10	110	1	5-Jun-16	0	10
38348	1	1817	Kurdofan	16-May-16	2	1	3	Dextrose + Softrax	2		14	2	6-Jun-16	0	21
36245	1	32	Kurdofan	2-Aug-15	2	1	4	Laxi + Fanco	2	60	3.2	1	3-Sep-15	0	32
34813	1	38	Kurdofan	27-Feb-15	2	1	4	Asphax + Vitamin D	2		1	2	4-Apr-15	0	36
27760	1	4	Kurdofan	7-Oct-12	2	1	4	Potassium + Calcium	2	42	2	1	29-Oct-12	0	22

36938	2	730	Kurdofan	11-Nov-15	2	1	5	Cainola + gentamycin	2	78	9.7	1	22-Dec-15	0	41
35287	2	730	Kurdofan	22-Apr-15	2	1	5	Samaxon + Sftax + Vitamin K	2	103	11	1	3-May-15	0	11
19723	1	300	Kurdofan	2-Oct-12	2	1	5	Cainola + Dextrose + Samson	2	67	6	1	6-Oct-12	0	4
33367	2	730	Kurdofan	13-Jun-16	2	1	5	Samson + Fanco + Ventolin	2		13	1	19-Jun-16	0	6
39077	2	730	Kurdofan	28-Aug-16	2	1	5	Canola + Dextrose + Kinin	2		10.5	1	1-Sep-16	0	4
37754	1	1460	Kurdofan	2-Mar-16	2	1	5	Samsung + laxi + fantolin	2		17	1	4-Mar-16	0	2
37151	1	1820	Kurdofan	19-Dec-15	2	1	5	FANTOLINE + SOMEXON	2		16	1	30-Dec-15	0	11
37767	2	1820	Kurdofan	6-Mar-16	2	1	5	Adrenaline + Hydrocertose + Intest	2	123	18.5	1	10-Mar-16	0	4
37464	1	1820	Kurdofan	26-Jan-16	2	1	5	Samcon + Canola	2		17	1	30-Jan-16	0	4
29705	2	1800	Kurdofan	10-May-14	2	1	5	Samson + Dextrose	2		22	3	20-Oct-14	0	163
34608	1	1817	Kurdofan	5-Feb-15	2	1	5	Softx + Dextrose + Vitamin (K)	2		21	1	22-Feb-15	0	17
25	2	730	Kurdofan	20-Nov-15	2	1	5	Cainola + gentamycin	2	50	3	1	21-Mar-16	0	122
30	1	730	Kurdofan	22-Apr-15	2	1	5	Samaxon + Sftax + Vitamin K	2	50	3	1	12-Mar-16	0	325
63	2	300	Kurdofan	2-Oct-14	2	1	5	Cainola + Dextrose + Samson	2	67	6	1	28-Jun-15	0	269
76	2	1460	Kurdofan	13-Jun-13	2	1	5	Samson + Fanco + Ventolin	2	104	15	1	16-Jul-14	0	398
84	1	1460	Kurdofan	28-Aug-12	2	1	5	Canola + Dextrose + Kinin	2	107	14.8	1	7-Oct-14	0	770
105	1	1460	Kurdofan	2-May-12	2	1	5	Samsung + laxi + fantolin	2	107	14.8	1	11-Nov-14	0	923
122	2	90	Kurdofan	19-Jan-14	2	1	5	FANTOLINE + SOMEXON	2	39	2	1	20-May-14	0	121
131	2	1095	Kurdofan	6-Mar-16	2	1	5	Adrenaline + Hydrocertose + Intest	2	115	22	1	10-Mar-16	0	4
137	2	730	Kurdofan	11-Mar-15	2	1	3	Dextrose + Sftrax + Fanco + Hydrochlorzone	2	50	3.2	1	20-Jun-15	0	101
143	2	1095	Kurdofan	26-May-14	2	1	3	Dextrose + Adrenaline + Sftrax	2	95	13	1	5-Nov-14	0	163
148	1	730	Kurdofan	16-May-12	2	1	3	Dextrose + Softrax	2	60	5	2	2-Jan-13	0	231
159	2	10	Kurdofan	11-Jul-13	2	1	3	Dextrose + Sftrax + Fanco + Hydrochlorzone	2	30	1.3	1	20-Jul-13	0	9
165	2	1095	Kurdofan	26-May-16	2	1	3	Dextrose + Adrenaline + Sftrax	2	95	15	1	7-Nov-16	0	165
170	1	1460	Kurdofan	16-May-14	2	1	3	Dextrose + Softrax	2	105	15	2	6-Oct-14	0	143
38570	2	720	Kurdofan	15-Jun-16	2	1	1	Sodium + Calcium + Furtam	2	77	9	1	20-Jun-16	1	5
378	2	720	Kurdofan	15-Jun-14	2	1	1	Sodium + Calcium + Furtam	2	58	4.5	1	20-Jul-14	1	35
33673	2	730	Libya-Omdurman	25-Oct-14	2	1	5	Samson + Entestine	2	84	10	2	9-Nov-14	0	15

31896	2	1460	Maio-Khartoum	12-Jan-14	2	1	1	Samson + Brideslone + Umbrazol	2		17.2	1	26-Jan-15	0	379
31615	1	1816	Maio-Khartoum	18-Nov-13	2	2	1	Laxxy + Sftraxone + Caenola	2	113	25	1	28-Nov-13	0	10
32410	1	26	Maio-Khartoum	17-Apr-14	2	1	2	Laxative + penicillin	2	85	4.3	1	28-Apr-14	0	11
31935	1	35	Maio-Khartoum	30-Jan-14	2	1	2	Laxi + andral + dextrose	2	56	3.5	3	24-Apr-14	0	84
36369	2	570	Maio-Khartoum	8-Sep-15	2	1	3	Canola + laxi + dextrose + amprazole	2	79	7.9	1	15-Sep-15	0	7
36647	1	1820	Maio-Khartoum	14-Oct-14	2	1	4	Dextrose + SoftX	2		4	1	14-Dec-14	0	61
25811	2	11	Maio-Khartoum	16-Jun-13	2	1	4	Fanco + Sftax + Phenamine (K)	2		1.5	1	21-Jul-13	0	35
34392	2	12	Maio-Khartoum	20-Jan-15	2	1	4	Softx + Fanco + Dextrose	2	45	2	1	5-Feb-15	0	16
25829	2	15	Maio-Khartoum	25-Jun-12	2	1	4	SoftX + Fanco	2	51	2.5	1	15-Jul-12	0	20
26864	1	16	Maio-Khartoum	2-Aug-12	2	1	4	SoftX + Empiclux	2	51	3	1	10-Sep-12	0	39
28940	1	17	Maio-Khartoum	4-Jan-12	2	1	4	SoftX + Oxygen	2	55	4.2	1	12-Jan-12	0	8
28417	2	18	Maio-Khartoum	26-Nov-12	2	1	4	SoftX + Empiclux	2	50	3.9	1	3-Dec-12	0	7
31733	1	18	Maio-Khartoum	8-Feb-12	2	1	4	Softx + Fanco + Dextrose	2	36	1.7	1	26-Dec-13	0	687
23356	2	1	Maio-Khartoum	10-Mar-12	2	1	4	Samsung + ampiclux	2		1.2	2	12-May-12	0	63
22231	2	43	Maio-Khartoum	7-Jan-12	2	1	4	SoftX + Fanco	2	46	1.2	1	18-Feb-12	0	42
17476	1	4	Maio-Khartoum	28-Jun-12	2	1	4	Samson + Calcium	2	50	3	1	24-Jul-12	0	26
36320	1	6	Maio-Khartoum	2-Sep-15	2	1	4	Sftax + Fanco + Vitamin K	2		2.5	1	12-Sep-15	0	10
29784	1	8	Maio-Khartoum	25-Mar-13	2	1	4	SoftX + Zinc + Fanco	2	42	1.6	1	21-Apr-13	0	27
20382	2	240	Maio-Khartoum	24-Feb-12	2	1	5	Samson + Dextrose	2	64	5	1	27-Feb-12	0	3
38521	1	730	Maio-Khartoum	8-Jun-16	2	2	5	Dextrose + Formem	2		10	1	20-Jun-16	0	12
30719	1	730	Maio-Khartoum	3-Jul-13	2	1	5	Cainola + Sftrexon + Glucose	2		12.2	2	3-Nov-14	0	488
35906	2	730	Maio-Khartoum	7-Jul-15	2	1	5	Samaxon + Ventolin + SoftX	2		8.5	1	6-Aug-15	0	30
37166	2	1095	Maio-Khartoum	20-Dec-15	2	1	5	Dextrose + Samson + Cainola	2		13	1	27-Dec-15	0	7
43747	2	1095	Maio-Khartoum	23-Oct-12	2	1	5	Samson + Dextrose	2		9	4	12-Dec-12	0	50
37426	1	1460	Maio-Khartoum	24-Jan-16	2	1	5	Samson + Ventolin	2		11	1	27-Jan-16	0	3
35257	2	1815	Maio-Khartoum	19-Apr-15	2	1	5	Samson + penicillin water	2	80	19	2	29-Aug-15	0	132
49504	2	1816	Maio-Khartoum	19-Aug-16	2	1	5	Samson + Saffron	2		18	1	20-Aug-16	0	1
35062	1	16	Maio-Khartoum	26-Mar-15	2	1	5	SoftX + ampiclos	2		9.5	4	18-Jan-16	0	298

37690	1	730	Maio-Khartoum	21-Feb-16	2	1	5	Samsung + laxi + dextrose	2		6.5	1	24-Feb-16	0	3
30427	1	730	Maio-Khartoum	14-Apr-14	2	1	5	Samsung + morphine + dextrose	2	34	12	2	4-Dec-14	0	234
35548	2	1095	Maio-Khartoum	24-May-15	2	1	5	SoftX + Fanco + Pendulum	2	91	12	1	4-Jun-15	0	11
32728	1	1460	Maio-Khartoum	28-May-14	2	1	5	Adrenaline + Hydrocertose + Intest	2		7.5	1	22-Jun-14	0	25
35912	2	240	Maio-Khartoum	24-Aug-15	2	1	5	Samson + Dextrose	2		6	1	27-Aug-15	0	3
36802	2	1800	Maio-Khartoum	1-Nov-15	2	1	5	Softx + Lazyx + Pendulum + Fanco	2		23	1	13-Nov-15	0	12
39056	2	1820	Maio-Khartoum	24-Aug-16	2	1	5	Folek + Entestine	2		30	1	24-Oct-16	0	61
20	1	730	Maio-Khartoum	8-Jun-16	2	2	5	Dextrose + Formem	2	50	3	1	31-Oct-16	0	145
28	1	730	Maio-Khartoum	3-Jul-13	2	1	5	Cainola + Sftrexon + Glucose	2	50	3	2	2-Jan-16	0	913
33	1	730	Maio-Khartoum	7-Jul-15	2	1	5	Samaxon + Ventolin + SoftX	2	50	3	1	22-Mar-16	0	259
36	2	1095	Maio-Khartoum	20-Dec-15	2	1	5	Dextrose + Samson + Cainola	2	95	13	1	29-Nov-16	0	345
37	1	1095	Maio-Khartoum	23-Oct-13	2	1	5	Samson + Dextrose	2	95	13	4	21-Nov-16	0	1125
41	1	1460	Maio-Khartoum	24-Jan-13	2	1	5	Samson + Ventolin	2	104	14	1	27-Nov-16	0	1403
52	1	1820	Maio-Khartoum	19-Apr-15	2	1	5	Samson + penicillin water	2	113	25	2	10-Dec-16	0	601
53	1	1820	Maio-Khartoum	19-Aug-16	2	1	5	Samson + Saffron	2	113	25	1	27-Dec-16	0	130
67	1	16	Maio-Khartoum	21-Jun-15	2	1	5	SoftX + ampiclos	2	34	2.3	4	29-Jun-15	0	8
82	1	730	Maio-Khartoum	21-Feb-13	2	1	5	Samsung + laxi + dextrose	2	50	3	1	6-Jul-14	0	500
86	1	1095	Maio-Khartoum	14-Apr-14	2	1	5	Samsung + morphine + dextrose	2	34	12	2	4-Oct-14	0	173
94	2	1460	Maio-Khartoum	24-May-14	2	1	5	SoftX + Fanco + Pendulum	2	107	14.8	1	13-Feb-16	0	630
106	1	1460	Maio-Khartoum	28-May-14	2	1	5	Adrenaline + Hydrocertose + Intest	2	107	14.8	1	17-Nov-14	0	173
138	1	570	Maio-Khartoum	8-Sep-15	2	1	3	Canola + laxi + dextrose + amprazole	2	45	3	1	15-Oct-15	0	37
160	1	570	Maio-Khartoum	8-May-13	2	1	3	Canola + laxi + dextrose + amprazole	2	79	7.9	1	12-Jul-13	0	65
206	2	1460	Maio-Khartoum	12-Jan-13	2	1	1	Samson + Brideslone + Umbrazol	2	110	17.2	1	26-Feb-13	0	45
32732	1	11	Maio-Khartoum	29-May-14	2	2	4	SoftX + Fanco	2	37	1	1	7-Jun-14	1	9
32950	2	1820	Maio-Khartoum	3-Jul-14	2	2	1	Samsung + calcium + dextrose + laxex	2	106	18	1	11-Jul-14	1	8
229	1	1	Maio-Khartoum	14-Dec-16	2	2	4	SoftX + Fanco	2	35	1	1	19-Dec-16	1	5
249	1	11	Maio-Khartoum	30-Nov-15	2	2	4	SoftX + Fanco	2	37	1	1	10-Dec-15	1	10
383	2	720	Maio-Khartoum	3-Feb-13	2	2	1	Samsung + calcium + dextrose + laxex	2	58	4.5	1	11-Feb-13	1	8

33621	1	90	Marawei-North Sudan	19-Oct-14	2	1	2	Lazzy + sprue	2	58	3	1	26-Dec-14	0	68
30627	1	10	Marawei-North Sudan	23-Jun-13	2	1	4	SoftX + Fanco	2	45	2.6	1	4-Jul-13	0	11
35329	1	1095	Northern State	26-Apr-15	2	1	1	Cainola	2	95	13	1	30-Apr-15	0	4
37661	1	270	Northern State	20-Feb-16	2	1	2	Softx + Lazyx + Dextrose	2		7	1	25-Feb-16	0	5
34335	2	540	Northern State	14-Jan-15	2	1	2	Laxi + saffron syrup	2	73	9	1	25-Jan-15	0	11
34335	2	365	Northern State	14-Jan-15	2	1	2	Saffron + Laxzy + Folek	2	73	9.6	1	25-Jan-15	0	11
38988	1	27	Northern State	16-Aug-16	2	1	4	SoftX + Fanco	2		3.1	1	7-Sep-16	0	22
34544	2	5	Northern State	6-Feb-15	2	1	4	Sftax + Fanco + Calcium	2	48	3.2	1	28-Feb-15	0	22
35063	1	270	Northern State	3-Apr-16	2	1	5	Dextrose + SoftX	2			1	8-Apr-16	0	5
33821	2	730	Northern State	11-Nov-14	2	1	5	Hibiarin + Antstein + Adrenaline	2		15	3	19-Oct-16	0	708
39428	1	1800	Northern State	19-Oct-16	2	1	5	Adrenaline + Hydrocertose + Intest	2		15	1	27-Oct-16	0	8
90	1	1095	Northern State	11-Nov-13	2	1	5	Hibiarin + Antstein + Adrenaline	2	95	13	3	7-Oct-14	0	330
201	1	365	Northern State	26-Apr-13	2	1	1	Cainola	2	35	2	1	20-Feb-14	0	300
37653	1	3	Northern State	17-Feb-16	2	2	4	SoftX + Fanco	2		0	1	19-Feb-16	1	2
241	2	23	Northern State	3-May-16	2	2	4	SoftX + Fanco	2	0	0	1	19-May-16	1	16
36967	1	120	Nyala - South Darfur	23-Nov-15	2	1	2	Lexus + samsung + zinc	2		4	1	26-Nov-15	0	3
38534	2	1815	Nyala - South Darfur	26-Jun-16	2	1	3	Hydrocerton + Adrenaline + Antist	2		20	1	29-Jun-16	0	3
35747	1	1095	Nyala - South Darfur	15-Jun-15	2	1	5	Cainola + Cyprofcomycin + Amy	2		13	1	25-Jul-15	0	40
37460	1	730	Nyala - South Darfur	25-Jan-16	2	1	5	Canola + Fanco + Salt Trail	2		11	2	6-Oct-16	0	255
33838	1	1460	Nyala - South Darfur	12-Nov-14	2	1	5	Heparin + Adrenaline	2		17	2	2-Feb-16	0	447
35747	1	1460	Nyala - South Darfur	15-Jun-15	2	1	5	Amicassin + Sprue	2		13	1	8-Jul-15	0	23
37549	1	1817	Nyala - South Darfur	17-Feb-16	2	1	5	Hydrocerton + Adrenaline + Antist	2	120	20	1	18-Feb-16	0	1
39436	1	450	Nyala - South Darfur	20-Oct-16	2	1	1	Samson + DXDroz	2		6.7	1	30-Oct-16	0	10
35	2	1095	Nyala - South Darfur	15-Jun-15	2	1	5	Cainola + Cyprofcomycin + Amy	2	95	13	1	21-Nov-16	0	525
75	1	90	Nyala - South Darfur	25-May-14	2	1	5	Canola + Fanco + Salt Trail	2	32	2.1	2	6-Jul-14	0	42
99	1	1460	Nyala - South Darfur	12-Nov-14	2	1	5	Heparin + Adrenaline	2	107	14.8	2	9-Apr-16	0	514
100	1	1095	Nyala - South Darfur	15-Jun-15	2	1	5	Amicassin + Sprue	2	69	9	1	22-Apr-16	0	312
151	2	330	Nyala - South Darfur	26-Jun-15	2	1	3	Hydrocerton + Adrenaline + Antis	2	35	2.2	1	29-Jun-15	0	3

173	1	1815	Nyala - South Darfur	26-Jun-16	2	1	3	Hydrocerton + Adrenaline + Antis	2	113	25	1	11-Oct-16	0	107
32731	1	180	Omdurman	11-Jun-14	2	1	2	Penicillin + gentamicin + laxacy	2	60	4.2	1	22-Jun-14	0	11
27879	1	3	Omdurman	15-Oct-12	2	1	4	Softx + Dextrose	2	49	3.5	1	27-Oct-12	0	12
29574	1	5	Omdurman	1-Mar-13	2	1	4	SoftX + Fanco	2	35	2.4	1	16-Mar-13	0	15
34022	1	1815	Omdurman	13-Jul-15	2	1	2	Lazzy + sprue	2		7	2	27-Aug-15	0	45
34922	2	270	Omdurman	10-Mar-15	2	1	1	Saffron syrup	2		4	1	12-Mar-15	0	2
38664	1	14	Omdurman	12-Jul-16	2	1	1	Laxxy + Samson + Fantolin	2		10	2	29-Jul-16	1	17
34832	1	20	Omdurman	1-Mar-15	2	1	4	Vancomycin + Formem	2		2.7	1	3-Mar-15	1	2
39246	1	1080	Omdurman	24-Sep-16	2	2	5	Softx + Dextrose + Folic Acid + Canola	2		11	1	28-Sep-16	1	4
34560	1	90	Omdurman	9-Feb-15	2	2	2	SoftX + Lazixi + SoftX	2	54	5	2	1-Apr-15	1	51
36998	1	26	Omdurman	24-Nov-15	2	1	1	Laxxy + Softraxone	2	8	11.5	1	28-Nov-15	0	4
38459	2	240	Omdurman	30-May-14	2	1	1	Dextrose + amprazole	2	72	8.5	1	2-Jun-14	0	3
39381	2	1800	Omdurman	11-Oct-16	2	1	1	Dextrose + caenola + laxoxy	2	125	20	2	1-Dec-16	0	51
36570	1	1820	Omdurman	6-Oct-15	2	1	1	Sftrax + Fanco + Canola	2	126	17.9	1	12-Oct-15	0	6
3E+05	2	270	Omdurman	6-Feb-14	2	2	2	Laxacy + vancomycin	2		4	1	10-Feb-14	0	4
33169	1	780	Omdurman	14-Aug-14	2	1	2	Dextrose + Antistine + Adrenaline	2		6	1	24-Aug-14	0	10
31388	2	90	Omdurman	24-Dec-14	2	1	2	Fanko + Flags + Samson + Ventolin	2		4	2	30-Jan-15	0	37
28215	2	120	Omdurman	8-Nov-12	2	1	2	Maxell + SoftX + Lazixi	2	57	5	1	14-Nov-12	0	6
37871	2	270	Omdurman	16-Mar-16	2	1	2	Laxxy + Fentuin + Fanco	2		3.5	1	24-Mar-16	0	8
35793	1	365	Omdurman	21-Jun-15	2	1	2	Penicillin + gentamicin	2		5.2	1	28-Jun-15	0	7
34211	2	730	Omdurman	30-Dec-15	2	2	2	Cainola	2	83	11	1	31-Dec-15	0	1
39172	2	25	Omdurman	17-Oct-15	2	1	2	LASIKI + MAXL + HYDROKARTZONE	2		5	1	25-Oct-15	0	8
32156	1	10	Omdurman	16-Mar-14	2	1	4	Laxi + Dextrose	2	37	1.3	1	24-Apr-14	0	39
34348	2	12	Omdurman	16-Jan-15	2	1	4	Fanko + Sftax + Fallahil	2		1.4	1	17-Feb-15	0	32
27845	1	14	Omdurman	15-Oct-12	2	1	4	SoftX + Fanco	2	41	2.5	1	27-Oct-12	0	12
27739	1	15	Omdurman	6-Oct-12	2	1	4	Fanco + Sftax + Phenamine (K)	2	51	3.9	1	15-Oct-12	0	9
38399	1	2	Omdurman	22-May-16	2	1	4	SoftX + Fanco	2		3.4	1	5-Jun-16	0	14
30855	1	2	Omdurman	25-Jul-13	2	1	4	SoftX + Fanco	2		3.5	1	28-Jul-13	0	3

35299	2	7	Omdurman	23-Apr-15	2	1	4	Svitax + Vitamin (K) + Dextrose	2	54	4.3		29-Apr-15	0	6
32046	1	1	Omdurman	24-Feb-15	2	1	4	Fanco + Sftax + Dextrose	2	42	2.5	1	5-Mar-15	0	9
34713	1	730	Omdurman	25-Jan-16	2	1	5	Samson + Hydrochlorzone	2		12	2	7-Sep-16	0	226
25583	2	1460	Omdurman	12-Jun-12	2	1	5	SoftX + Canola	2		14.5	1	13-Jun-12	0	1
37939	2	1800	Omdurman	24-Mar-16	2	1	5	Samson + Dextrose	2		19	1	27-Mar-16	0	3
36107	2	1800	Omdurman	6-Aug-15	2	1	5	Penicillin + dextrose	2		20	1	11-Aug-15	0	5
38187	1	365	Omdurman	23-Dec-15	2	1	5	Hydrecertone + Insulin + Adrenaline	2		12	2	6-Mar-16	0	74
15249	1	780	Omdurman	27-Mar-12	2	1	5	Samson + Fantolin	2		9	3	23-Jul-12	0	118
15809	2	730	Omdurman	21-Apr-12	2	1	5	Samson + Dextrose	2		10	1	22-Apr-12	0	1
2025	1	1460	Omdurman	11-Oct-15	2	1	5	Samson + Adrenaline	2	35	13	1	12-Oct-15	0	1
31149	2	1460	Omdurman	1-Sep-13	2	1	5	Dextrose + samsung + folic acid + zinc	2		15	3	23-Jan-15	0	509
33663	1	1820	Omdurman	23-Oct-14	2	1	5	Ombrazole + laxi	2		15	1	25-Oct-14	0	2
31833	1	1820	Omdurman	28-Feb-13	2	1	5	Samsung + pendulum + canola	2	112	15	3	26-May-15	0	817
38888	1	1820	Omdurman	4-Aug-16	2	1	5	Samsung + folic + spruce	2	110	25	1	14-Aug-16	0	10
28721	1	1820	Omdurman	4-Jun-14	2	1	5	Sftrax + Dextrose + Canola	2	98	13.5	1	8-Jun-14	0	4
30190	2	1800	Omdurman	26-Jun-16	2	2	5	Hydrocerton + Adrenaline + Afank	2		15	2	20-Sep-16	0	86
72787	2	1800	Omdurman	3-Oct-15	2	1	5	Samson + Dectrose	2		20	1	6-Oct-16	0	369
39672	2	1809	Omdurman	23-Nov-16	2	1	5	Samson + Fanko + Provin	2		17	1	1-Dec-16	0	8
0	1	180	Omdurman	22-Jan-14	2	1	2	Laxzy + the Dictator	2	54	5	2	1-Apr-14	0	69
36677	2	25	Omdurman	17-Oct-15	2	1	2	Laxix + Maxel + Hydrecertone	2		5	1	25-Oct-16	0	374
3	2	730	Omdurman	1-Dec-12	2	1	5	Samson + Fanko + Provin	2	32	2	1	31-Dec-14	0	760
15	2	1095	Omdurman	17-Jan-15	2	1	5	Maxil + Ventolin + Dextrose	2	95	13	1	21-Mar-16	0	429
16	2	1460	Omdurman	24-Dec-13	2	1	5	Samson + Dextrose	2	104	15	1	21-Mar-15	0	452
17	2	1460	Omdurman	24-Dec-14	2	1	5	Dextrose + SoftX	2	104	15	1	21-Mar-16	0	453
29	1	730	Omdurman	25-Jan-16	2	1	5	Samson + Hydrochlorzone	2	50	3	2	2-Mar-16	0	37
31	1	730	Omdurman	25-Oct-14	2	1	5	Samson + Entestine	2	50	3	2	23-Mar-16	0	515
42	1	1460	Omdurman	12-Jun-13	2	1	5	SoftX + Canola	2	104	14	1	22-Mar-16	0	1014
51	1	1800	Omdurman	24-Mar-16	2	1	5	Samson + Dextrose	2	113	25	1	27-Dec-16	0	278

59	2	1820	Omdurman	6-Aug-15	2	1	5	Penicillin + dextrose	2	113	25	1	12-Dec-16	0	494
70	1	1460	Omdurman	23-Dec-15	2	1	5	Hydrecertone + Insulin + Adrenaline	2	105	12	2	28-Jun-16	0	188
74	1	80	Omdurman	20-Jun-15	2	1	5	Samson + Fantolin	2	31	2.1	3	28-Jun-15	0	8
78	2	1460	Omdurman	21-Dec-12	2	1	5	Samson + Dextrose	2	107	14.8	1	21-Jul-14	0	577
98	1	1460	Omdurman	11-Oct-15	2	1	5	Samson + Adrenaline	2	107	14.8	1	14-Apr-16	0	186
102	1	150	Omdurman	1-Sep-13	2	1	5	Dextrose + samsung + folic acid + zinc	2	30	2	3	22-Nov-14	0	447
109	1	1820	Omdurman	23-Oct-14	2	1	5	Ombrazole + laxi	2	113	25	1	22-Nov-14	0	30
114	2	1805	Omdurman	4-Oct-12	2	1	5	Samsung + pendulum + canola	2	113	25	3	30-Nov-14	0	787
117	2	1820	Omdurman	4-Aug-12	2	1	5	Samsung + folic + spruce	2	113	25	1	3-Nov-14	0	821
125	2	1095	Omdurman	4-Jun-12	2	1	5	Sftrax + Dextrose + Canola	2	98	13.5	1	30-May-14	0	725
194	1	26	Omdurman	24-Jun-15	2	1	1	Laxxy + Softraxone	2	8	11.5	1	28-Jun-15	0	4
198	2	240	Omdurman	30-May-16	2	1	1	Dextrose + amprazole	2	32	2.5	1	2-Jun-16	0	3
222	1	12	Omdurman	13-Feb-14	2	2	4	Flagell	2	40	2.3	1	17-Feb-14	1	4
240	2	22	Omdurman	2-May-16	2	2	4	Fanko + SoftX	2	37	1.2	1	18-May-16	1	16
260	2	6	Omdurman	18-Oct-15	2	2	4	Fanko + SoftX	2	37	2.2	1	22-Oct-15	1	4
267	1	30	Omdurman	8-Oct-16	2	2	4	Fanco + Sftax + Vitamin K	2	43	1.9	1	17-Oct-16	1	9
282	1	25	Omdurman	6-Jul-14	2	2	4	SoftX + Fanco	2	30	1.8	1	18-Jul-14	1	12
294	1	90	Omdurman	3-Jan-14	2	1	4	Vancomycin + Formem	2	30	2.7	1	3-Feb-14	1	31
308	1	377	Omdurman	16-May-13	2	2	4	Fanco + Sftax + Vitamin K	2	41	3.6	1	14-Jun-13	1	29
313	2	300	Omdurman	26-Jun-13	2	1	4	Calcium	2	39	2.2	1	25-Jul-13	1	29
315	2	350	Omdurman	1-Jul-13	2	1	4	Vancomycin + SoftX	2	40	2.6	1	27-Jul-13	1	26
317	1	11	Omdurman	5-Jul-13	2	2	4	Fanco + Sftax + Dextrose	2	0	2.3	1	30-Jul-13	1	25
326	1	24	Omdurman	4-Apr-13	2	2	4	Fanco	2	34	2.2	1	15-Apr-13	1	11
344	1	4	Omdurman	1-Sep-13	2	2	4	SoftX + Fanco	2	50	2.7	1	21-Sep-13	1	20
348	1	1080	Omdurman	24-Sep-16	2	2	5	Softx + Dextrose + Folic Acid + Canola	2	58	4.5	1	28-Sep-16	1	4
351	1	1080	Omdurman	24-Nov-13	2	2	5	Softx + Dextrose + Folic Acid + Canola	2	58	4.5	1	28-Dec-13	1	34
354	1	1080	Omdurman	24-Sep-16	2	2	5	Softx + Dextrose + Folic Acid + Canola	2	58	4.5	1	28-Sep-16	1	4
357	1	1080	Omdurman	24-Nov-13	2	2	5	Softx + Dextrose + Folic Acid + Canola	2	58	4.5	1	28-Dec-13	1	34

360	1	1080	Omdurman	24-Mar-16	2	2	3		2	58	4.5	1	28-Apr-16	1	35
374	1	90	Omdurman	9-Feb-15	2	2	3		2	30	2	2	1-Apr-15	1	51
380	2	14	Omdurman	12-Jul-14	2	1	1	Laxxy + Samson + Fantolin	2	0	10	2	29-Aug-14	1	48
38404	2	630	Others places in Sudan	24-May-16	2	1	1	Laxxy + Samaxon + Vancomycin	2	58	4.5	1	31-May-16	1	7
11860	2	4	Others places in Sudan	9-Aug-16	2	1	1	Samson + Hydrocrackon	2		10	1	25-Aug-16	1	16
34626	2	1	Others places in Sudan	11-Feb-15	2	1	4	Calcium	2	39	1.2	1	14-Feb-15	1	3
38678	2	1	Others places in Sudan	8-Jul-16	2	2	4	Softx + Fanco + Potassium	2		1.8	1	17-Jul-16	1	9
34239	1	360	Others places in Sudan	1-Jan-15	2	2	2	Laxi + maxil + dextrose	2		6	2	14-Feb-15	1	44
218	2	16	Others places in Sudan	28-Nov-16	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	30-Nov-16	1	2
223	1	3	Others places in Sudan	14-Feb-14	2	2	4	SoftX + Fanco	2	50	2.7	1	17-Feb-14	1	3
224	1	14	Others places in Sudan	15-Feb-14	2	2	4	Softax + Flagl	2	43	1.8	1	17-Feb-14	1	2
261	2	11	Others places in Sudan	16-Oct-15	2	2	4	SoftX + Fanco	2	35	2	1	23-Oct-15	1	7
273	1	1	Others places in Sudan	2-Mar-14	2	1	4	Calcium	2	30	1.2	1	5-Mar-14	1	3
280	2	21	Others places in Sudan	4-Nov-14	2	2	4	Fanco	2	39	1	1	9-Nov-14	1	5
283	1	730	Others places in Sudan	10-Jul-14	2	2	4	Flagell	2	58	4.5	1	21-Sep-14	1	73
284	1	730	Others places in Sudan	10-Jul-14	2	2	4	SoftX + Fanco	2	58	4.5	1	27-Sep-14	1	79
287	2	450	Others places in Sudan	11-Jul-14	2	2	4	Fanko + SoftX	2	41	3.6	1	13-Aug-14	1	33
318	1	450	Others places in Sudan	7-Jun-13	2	2	4	Fanko + SoftX	2	43	2.3	1	31-Jul-13	1	54
319	2	1	Others places in Sudan	8-Jun-13	2	2	4	Softx + Fanco + Potassium	2	41	1.8	1	1-Aug-13	1	54
341	1	375	Others places in Sudan	2-Aug-13	2	2	4	Fanko + SoftX	2	37	3.2	1	10-Aug-13	1	8
375	1	360	Others places in Sudan	1-Jan-15	2	2	3		2	35	2.9	2	14-Feb-15	1	44
377	2	350	Others places in Sudan	24-Oct-14	2	1	1	Laxxy + Samaxon + Vancomycin	2	38	2.5	1	20-Nov-14	1	27
379	2	4	Others places in Sudan	1-Aug-14	2	1	1	Samson + Hydrocrackon	2	30	10	1	9-Aug-14	1	8
36880	1	1	Others places in Sudan	11-Nov-15	2	2	4	Calcium + Caenola	2		2	1	15-Nov-15	0	4
36726	2	11	Others places in Sudan	13-Oct-15	2	1	4	Dextrose + Sftax + Flags	2	36	1.6	1	25-Oct-15	0	12
35364	2	14	Others places in Sudan	29-Apr-15	2	1	4	Vitamin (D + C) Fanco	2		1	1	17-Jun-15	0	49
35433	1	24	Others places in Sudan	6-May-15	2	1	4	Sftax + Fanco + Flagel	2		1.6	1	26-Jun-15	0	51
35004	1	26	Others places in Sudan	19-Mar-15	2	1	4	Meronem + Extroz	2	49	2.5	1	31-Mar-15	0	12

31956	2	2	Others places in Sudan	3-Feb-14	2	1	4	SoftX + Fanco	2	40	2.8	1	23-Feb-14	0	20
31406	1	33	Others places in Sudan	10-Oct-13	2	1	4	Fanko + SoftX	2	42	2.6	1	20-Oct-13	0	10
32612	2	39	Others places in Sudan	13-May-14	2	1	4	Flags + Fanco + Sftax	2	36	1.3	1	4-Jun-14	0	22
31882	1	3	Others places in Sudan	19-Jan-14	2	1	4	SoftX + Fanco	2		1.3	1	23-Feb-14	0	35
32149	1	4	Others places in Sudan	16-Mar-14	2	1	4	Fanko + SoftX	2	67	3	1	4-Apr-14	0	19
38333	1	5	Others places in Sudan	3-Jun-16	2	1	4	Dextrose + Calcium	2	52	3.3	1	27-Jun-16	0	24
33136	1	8	Others places in Sudan	12-Aug-14	2	1	4	Fanko + SoftX	2		2.4	1	19-Aug-14	0	7
33197	1	9	Others places in Sudan	8-Aug-14	2	1	4	SoftX + Fanco	2	40	2	1	26-Aug-14	0	18
36880	1	1	Others places in Sudan	11-Nov-15	2	1	4	Fanko + SoftX	2		2.2	1	15-Nov-15	0	4
31890	1	1095	Others places in Sudan	20-Jan-14	2	1	5	Sprou + Micasin	2	90	15	1	27-Jan-14	0	7
38491	1	5	Others places in Sudan	3-Jun-16	2	1	4	Dextrose + Calcium	2	52	3.3	1	27-Jun-16	0	24
37273	1	1810	Port Sudan-East Sudan	17-Jan-16	2	1	1	Vancomycin + Caniola	2	116	24	1	24-Jan-16	0	7
23616	2	1820	Port Sudan-East Sudan	20-Oct-14	2	1	3	Vancomycin + Canpola + Vortem + Dextrose	2		11	3	30-Oct-14	0	10
35823	2	1820	Port Sudan-East Sudan	24-Jun-15	2	1	3	Vortem + dextrose + pendulum syrup	2		18	3	12-Sep-15	0	80
134	2	1800	Port Sudan-East Sudan	20-Jan-16	2	1	3	Vancomycin + Canapola + Vortem	2	113	25	3	30-Mar-16	0	70
135	2	1815	Port Sudan-East Sudan	24-Jan-16	2	1	3	Vortem + dextrose + pendulum syrup	2	113	25	3	12-Mar-16	0	48
156	1	30	Port Sudan-East Sudan	20-Apr-14	2	1	3	Vancomycin + Canola + Vortem + Dextrose	2	30	2	3	18-May-14	0	28
157	1	35	Port Sudan-East Sudan	24-May-13	2	1	3	Vortem + dextrose + pendulum syrup	2	30	1.9	3	12-Jun-13	0	19
37358	1	50	Rabak-White Nile	13-Jan-16	2	1	2	Laxix + Dextrose + Fantolin	2	50	3.5	1	25-Jan-16	1	12
35124	1	210	Rabak-White Nile	1-Apr-15	2	1	2	Zinc + Oxygen + Penicillin + Canola	2	66	5	2	18-Jun-15	0	78
35979	1	2	Rabak-White Nile	22-Jul-15	2	1	4	Softx + Dextrose	2		2.9	1	6-Aug-15	0	15
20164	2	1460	Rabak-White Nile	14-Oct-12	2	1	5	Penicillin + dextrose	2	68	14	2	15-Jan-13	0	93
32588	1	1095	Rabak-White Nile	11-May-14	2	1	2	Dr. Samson + Maxine	2	105	10	1	15-May-14	0	4
43	1	1460	Rabak-White Nile	14-Oct-13	2	1	5	Penicillin + dextrose	2	104	14	2	25-Nov-16	0	1138
39731	2	1460	River Nile	1-Dec-15	2	1	1	Dextrose + Sftrax + Canola	2	93	10.7	1	24-Jan-16	0	54
34517	1	2	River Nile	2-Feb-15	2	1	4	SoftX + Fanco	2	47	2.3	1	19-Feb-15	0	17
36395	1	6	Rofaah-El Gezira	12-Sep-15	2	2	4	Vortem + Vancomycin	2	49	3.2	1	15-Sep-15	0	3
39048	1	61	Rumaila-Khartoum	23-Aug-16	2	1	4	SoftX	2		3.8	1	31-Aug-16	0	8

31434	1	1815	Sharg El Nil-Khartoum	10-Oct-13	2	1	1	Samson + Zinc + Ventolin	2	110	15.5	3	10-Aug-14	0	304
34934	1	1816	Sharg El Nil-Khartoum	1-Mar-15	2	1	1	Vancomycin + flagel + vinin + dextrose	2		19	2	3-Apr-15	0	33
35381	1	1817	Sharg El Nil-Khartoum	2-May-15	2	1	1	Samaxon + Dextrose + Formam + Embrazole	2	109	13.2	1	14-May-15	0	12
38154	1	1817	Sharg El Nil-Khartoum	19-Apr-16	2	1	1	Laxzy + Nevden	2	135	35	1	24-Apr-16	0	5
29583	2	1817	Sharg El Nil-Khartoum	1-Mar-13	2	1	1	Seftrax + Laszky	2		35	1	12-Mar-13	0	11
39718	1	240	Sharg El Nil-Khartoum	30-Nov-16	2	1	2	Maxell + Hepburn	2		5.5	1	3-Dec-16	0	3
30651	1	10	Sharg El Nil-Khartoum	28-Jun-13	2	1	4	Samaxon + Sftax + Calcium	2	41	1.5	1	8-Jul-13	0	10
34910	2	12	Sharg El Nil-Khartoum	12-Mar-15	2	1	4	Sftax + Fanco + Vitamin K	2		2.6	1	22-Mar-15	0	10
29538	1	13	Sharg El Nil-Khartoum	23-Feb-13	2	1	4	Svitax + Vitamin K	2		3.5	1	5-Mar-13	0	10
30678	2	14	Sharg El Nil-Khartoum	30-Jun-13	2	1	4	Potassium + Calcium	2	41	1.3	1	8-Jul-13	0	8
22683	1	15	Sharg El Nil-Khartoum	8-Feb-12	2	1	4	SoftX + Fanco	2	35	2	1	12-Feb-12	0	4
39000	2	16	Sharg El Nil-Khartoum	17-Aug-16	2	1	4	SoftX + Fanco	2		2.2	1	30-Aug-16	0	13
35307	1	16	Sharg El Nil-Khartoum	3-Apr-14	2	1	4	Softx + Fanco + Dextrose	2	66	2.3	1	6-Apr-14	0	3
28142	1	20	Sharg El Nil-Khartoum	1-Nov-12	2	1	4	Svitax + Vitamin K	2	54	3.6	1	12-Nov-12	0	11
26505	1	28	Sharg El Nil-Khartoum	1-Aug-12	2	1	4	Fanko + SoftX	2		3	1	13-Aug-12	0	12
26168	1	2	Sharg El Nil-Khartoum	12-Jul-12	2	1	4	Water penicillin + dextrose	2		3	1	17-Jul-12	0	5
33123	2	2	Sharg El Nil-Khartoum	8-Aug-14	2	1	4	SoftX + ANCO	2	50	2.6	1	17-Aug-14	0	9
29678	1	2	Sharg El Nil-Khartoum	3-Mar-13	2	1	4	Fanko + Flagl	2	36	2.6	1	27-Mar-13	0	24
38456	1	31	Sharg El Nil-Khartoum	30-May-16	2	1	4	Potassium + Vancomycin	2	46	2.9	1	10-Jun-16	0	11
26291	1	3	Sharg El Nil-Khartoum	20-Jul-12	2	1	4	Sfnax + Fanco + Vitamin K	2	39	1.5	1	24-Jul-12	0	4
32826	1	3	Sharg El Nil-Khartoum	3-Jun-14	2	1	4	SoftX + Fanco	2		3.4	1	20-Jun-14	0	17
24123	1	4	Sharg El Nil-Khartoum	15-Apr-12	2	1	4	Fanko + SoftX	2	45	2.7	1	19-Apr-12	0	4
32613	2	4	Sharg El Nil-Khartoum	14-May-14	2	1	4	Vagel + Sftax + Fanco	2	34	1.3	1	28-May-14	0	14
25238	1	5	Sharg El Nil-Khartoum	26-May-12	2	2	4	Samson + Vitamin K	2	49	2.6	1	30-May-12	0	4
34159	2	6	Sharg El Nil-Khartoum	22-Dec-14	2	1	4	Flags + Sftax	2		2.6	1	13-Jan-15	0	22
27703	2	7	Sharg El Nil-Khartoum	4-Oct-12	2	1	4	Softx + Fanco + Dextrose	2	48	2.8	1	11-Oct-12	0	7
35482	2	7	Sharg El Nil-Khartoum	13-May-15	2	1	4	SoftX + Vano	2	42	1.3	1	2-Jun-15	0	20
26463	1	365	Sharg El Nil-Khartoum	30-Jul-12	2	1	4	Softx + penicillin water	2	49	2.7	1	10-Aug-12	0	11

24983	1	150	Sharg El Nil-Khartoum	18-May-12	2	1	4	Potassium + Calcium	2		1.4	1	2-Jun-12	0	15
24732	1	1	Sharg El Nil-Khartoum	8-May-12	2	1	4	Samsung + sftax + fentwin	2	45	4	1	6-Jun-12	0	29
25108	1	1	Sharg El Nil-Khartoum	19-May-12	2	1	4	Gentamicin + Pensilib water	2	38	1.4	1	8-Jun-12	0	20
11541	1	365	Sharg El Nil-Khartoum	10-Mar-16	2	1	5	Adrenaline + Hydrocertose + Intest	2		10	1	13-Mar-16	0	3
33793	1	730	Sharg El Nil-Khartoum	10-Nov-14	2	1	5	Samsung + kenin + dextrose	2		16	2	12-Dec-14	0	32
36288	2	730	Sharg El Nil-Khartoum	31-Aug-14	2	1	5	Samson + Faulk	2	34	9	2	28-Oct-15	0	423
28176	2	1820	Sharg El Nil-Khartoum	7-Nov-12	2	1	5	Morphine + Caniola	2		16	1	12-Nov-16	0	1466
30644	1	1820	Sharg El Nil-Khartoum	1-Jul-14	2	1	5	Samson + Fanco + Ventolin + Dextrose	2	115	17	3	25-May-16	0	694
72	1	1460	Sharg El Nil-Khartoum	10-Mar-14	2	1	5	Adrenaline + Hydrocertose + Intest	2	105	12	1	28-Jun-15	0	475
77	1	730	Sharg El Nil-Khartoum	10-Jan-14	2	1	5	Samsung + kenin + dextrose	2	50	3	2	22-Jul-14	0	193
85	1	730	Sharg El Nil-Khartoum	31-Aug-14	2	1	5	Samson + Faulk	2	34	9	2	7-Oct-14	0	37
108	1	1820	Sharg El Nil-Khartoum	7-Nov-12	2	1	5	Morphine + Caniola	2	113	25	1	15-Nov-14	0	738
128	2	730	Sharg El Nil-Khartoum	1-Jul-13	2	1	5	Samson + Fanco + Ventolin + Dextrose	2	44	3.3	3	12-May-14	0	315
27537	2	1095	Shendi-River Nile	24-Sep-12	2	2	1	Penicillin + canola	2	81	12	1	27-Sep-12	0	3
35313	2	1801	Shendi-River Nile	6-Jun-15	2	1	1	Canola + Sftrax + Sodium	2		25	1	10-Jun-15	0	4
31898	2	90	Shendi-River Nile	23-Jan-12	2	1	2	Laxi + Ventolin + Canola	2	59	5	1	27-Jan-12	0	4
37370	1	900	Shendi-River Nile	16-Jan-16	2	1	2	Empiclux + SoftX	2		3	1	26-Jan-16	0	10
34651	1	14	Shendi-River Nile	18-Feb-15	2	1	4	Sftax + Fanco + Flagel	2	46	1.8	1	12-Mar-15	0	22
202	1	365	Shendi-River Nile	24-Sep-12	2	2	1	Penicillin + canola	2	35	2	1	27-Jan-13	0	125
27	1	730	Sinja-Sinnar	7-Jun-13	2	1	5	Dextrose + Morphine + Caenola	2	50	3	1	12-Jan-16	0	949
38161	1	1800	Sinnar	20-Apr-16	2	1	2	Laxix + Sftrexone + Vancomycin	2	100	14.5	1	23-Apr-16	1	3
37078	1	43	Sinnar	9-Dec-15	2	1	2	Vancomycin + Sftax + Laxxy	2		2	1	28-Dec-15	1	19
23269	1	270	Sinnar	25-May-14	2	1	1	Sftrax + Sftax + Dextrose	2	77	8.3	1	23-Jun-14	0	29
36711	2	1460	Sinnar	20-Oct-15	2	1	1	Dextrose + amprazole + sulfatex + calcium	2	104	15	1	8-Nov-15	0	19
34606	2	180	Sinnar	15-Feb-15	2	1	2	Maxil + pendulum + laxacy	2	54	3.5	1	19-Feb-15	0	4
32817	1	365	Sinnar	11-Jun-14	2	1	3	Adrenaline + Hydrocertose + Intest	2		7	2	18-Aug-14	0	68
37442	1	1080	Sinnar	22-Jan-16	2	1	3	Samson + Dextrose + Fanco + Canola	2		10	1	7-Feb-16	0	16
24175	1	6	Sinnar	12-Apr-12	2	1	4	Softx + Dextrose	2	43	2.4	1	24-Apr-12	0	12

38262	1	8	Sinnar	4-May-16	2	1	4	SoftX + Cainola	2		2.3	1	21-May-16	0	17
25530	1	730	Sinnar	7-Jun-12	2	1	5	Dextrose + Morphine + Caenola	2	87	12	1	11-Jun-12	0	4
32069	2	1095	Sinnar	2-Mar-14	2	1	5	Cainola + Dextrose + Sftrax + Zinc	2		12	3	25-Mar-15	0	388
32729	2	1810	Sinnar	2-Sep-14	2	1	5	Hepburn + Folek	2		15	2	1-Dec-14	0	90
38924	2	1820	Sinnar	24-Sep-16	2	1	5	Dextrose + Morphine + Caenola	2		18.7	2	10-Dec-16	0	77
35067	2	1810	Sinnar	28-Mar-15	2	1	5	Kenin + dextrose + canniola	2		30	1	1-Apr-15	0	4
37734	1	1815	Sinnar	29-Feb-16	2	1	5	Fanko + Samson + Laxzy	2		12	2	28-Apr-16	0	59
34	2	1095	Sinnar	2-Mar-14	2	1	5	Cainola + Dextrose + Sftrax + Zinc	2	95	13	3	25-Nov-16	0	999
48	1	1810	Sinnar	2-Sep-14	2	1	5	Hepburn + Folek	2	113	25	2	1-Dec-16	0	821
127	2	365	Sinnar	24-Sep-13	2	1	5	Dextrose + Morphine + Caenola	2	40	2.7	2	30-May-14	0	248
139	1	365	Sinnar	11-Jun-14	2	1	3	Adrenaline + Hydrocertose + Intest	2	35	2	2	18-Oct-14	0	129
144	1	1080	Sinnar	22-Jan-14	2	1	3	Samson + Dextrose + Fanco + Canola	2	95	13	1	7-Nov-14	0	289
161	1	365	Sinnar	11-Jun-15	2	1	3	Adrenaline + Hydrocertose + Intest	2	35	2.4	2	18-Mar-16	0	281
166	1	1080	Sinnar	22-Jan-15	2	1	3	Samson + Dextrose + Fanco + Canola	2	95	13	1	7-Jun-15	0	136
199	2	270	Sinnar	25-May-14	2	1	1	Sftrax + Sftax + Dextrose	2	37	2.7	1	23-Jun-14	0	29
32300	2	7	Soba-Khartoum	1-Apr-16	2	2	4	Fanko + SoftX	2	41	1.6	1	7-Apr-16	1	6
37788	1	420	Soba-Khartoum	4-Apr-16	2	2	5	Svitax + Vitamin K	2		27	1	22-May-16	1	48
31181	1	26	Soba-Khartoum	27-Aug-13	2	1	4	Sftax + Fanco + Vitamin K	2	49	2.9	1	26-Sep-13	0	30
28657	1	2	Soba-Khartoum	14-Feb-12	2	1	4	SoftX + Fanco	2	34	1	1	17-Jul-12	0	154
39259	1	3	Soba-Khartoum	25-Sep-16	2	1	4	Sftax + Fanco + Whiteman (K)	2		2.8	1	6-Oct-16	0	11
24577	1	5	Soba-Khartoum	2-May-12	2	1	4	SoftX + Empiclux	2	46	4	1	6-May-12	0	4
30743	1	5	Soba-Khartoum	7-Jul-13	2	1	4	Softx + Fanco + Dextrose	2	40	1.5	1	23-Jul-13	0	16
26244	1	5	Soba-Khartoum	16-Nov-12	2	1	4	SoftX + Fanco	2		2.3	1	25-Dec-12	0	39
26595	1	7	Soba-Khartoum	7-Aug-12	2	1	4	Softx + Dextrose	2	44	1.6	1	23-Aug-12	0	16
23709	2	7	Soba-Khartoum	24-Mar-12	2	1	4	SoftX + Fanco	2	46	2	1	28-Mar-12	0	4
28823	2	7	Soba-Khartoum	31-Dec-12	2	1	4	Svitax + Vitamin K	2	44	1.4	1	2-Jan-13	0	2
33082	1	1	Soba-Khartoum	29-Jul-14	2	1	4	Fanko + SoftX	2		1.8	1	19-Aug-14	0	21
30631	1	730	Soba-Khartoum	24-Jun-13	2	1	5	Transferring red blood cells	2		11	1	25-Jun-13	0	1

36699	2	730	Soba-Khartoum	20-Oct-15	2	1	5	Softxon + Dextrose + Cainola + Pendulum	2		8	1	3-Nov-15	0	14
27308	1	1817	Soba-Khartoum	10-Jan-15	2	1	5	Morphine + dextrose	2		17	1	15-Jan-15	0	5
35873	1	14	Soba-Khartoum	1-Jul-15	2	1	5	Samson + Hydrocerton + Adrana	2		10	2	6-Dec-15	0	158
22977	2	270	Soba-Khartoum	23-Feb-12	2	1	5	Canola + epoprofen + cloxylene	2	65	7	1	29-Feb-12	0	6
23	2	1460	Soba-Khartoum	20-Dec-13	2	1	5	Softxon + Dextrose + Cainola + Pendulum	2	50	3	1	31-Jan-16	0	772
47	1	1817	Soba-Khartoum	10-Jan-15	2	1	5	Morphine + dextrose	2	113	25	1	22-Dec-16	0	712
66	2	14	Soba-Khartoum	20-Jun-15	2	1	5	Samson + Hydrocerton + Adrana	2	34	2	2	28-Jun-15	0	8
246	2	22	Soba-Khartoum	17-Nov-15	2	2	4	Fanko + SoftX	2	41	1.6	1	7-Dec-15	1	20
327	1	7	Soba-Khartoum	5-Apr-13	2	2	4	Fanko + SoftX	2	41	1.6	1	6-Apr-13	1	1
347	1	420	Soba-Khartoum	4-Apr-13	2	2	5	Svitax + Vitamin K	2	33	3	1	22-Jun-13	1	79
350	1	420	Soba-Khartoum	4-Apr-13	2	2	5	Svitax + Vitamin K	2	33	2.7	1	22-Jun-13	1	79
353	2	420	Soba-Khartoum	29-Sep-15	2	2	5	Svitax + Vitamin K	2	0	27	1	22-Dec-15	1	84
356	1	420	Soba-Khartoum	4-Apr-13	2	2	5	Svitax + Vitamin K	2		2.7	1	22-Jun-13	1	79
359	2	420	Soba-Khartoum	4-Apr-15	2	2	3		2	37	2.7	1	22-Jun-15	1	79
11037	1	20	Sororab-Bahri	29-Jun-15	2	1	4	SoftX + Fanco	2		2.8	1	8-Jul-15	0	9
39906	2	90	South Africa	28-Dec-16	2	1	5	Samson + Fanco	2	97	14	1	30-Dec-16	0	2
23409	1	3	Toti-Khartoum	13-Mar-12	2	1	4	Softx + Dextrose	2	53	2.5	1	15-Mar-12	0	2
31108	1	4	Toti-Khartoum	24-Aug-13	2	1	4	Fanco + Sftax + Calcium	2	37	2	1	3-Sep-13	0	10
29111	1	365	Toti-Khartoum	22-Jan-13	2	1	4	SoftX + Ventolin	2		9	1	31-Jan-13	0	9
26254	2	1	Um Dom-Khartoum	17-Jul-12	2	1	4	Samsung + ampiclux	2	45	1.8	1	23-Jul-12	0	6
31744	1	1820	Um Rawaba-Kurdofan	8-Dec-13	2	1	1	Samsung + laxi + fantolin	2	114	23.5	1	11-Dec-13	0	3
34073	2	1460	Um Rawaba-Kurdofan	14-Dec-12	2	1	5	Cainola + adrenaline	2	104	14	3	6-Apr-16	0	1209
34637	1	1820	Um Rawaba-Kurdofan	17-Feb-15	2	1	5	Sftrax + Dextrose + Canola	2		13	1	19-Feb-15	0	2
39	1	1460	Um Rawaba-Kurdofan	14-Dec-12	2	1	5	Cainola + adrenaline	2	104	14	3	15-Nov-16	0	1432
113	2	1820	Um Rawaba-Kurdofan	17-Feb-13	2	1	5	Sftrax + Dextrose + Canola	2	113	25	1	15-Mar-14	0	391
37870	2	210	Wad Madani-El Gezira	16-Mar-16	2	2	1	Sftrax + Dextrose + Embrazol + Fanco	2	52	3.3	1	22-Apr-16	1	37
29148	1	11	Wad Madani-El Gezira	5-Dec-13	2	1	4	SoftX + Fanco	2	48	2.5	1	31-Jan-14	0	57
25312	2	5	Wad Madani-El Gezira	28-May-12	2	1	4	Samson + Dextrose	2	47	3	1	6-Jun-12	0	9

38119	1	1820	West Kordofan	17-Apr-16	2	2	5	Dextrose + Sftrexone	2		20	1	29-Apr-16	0	12
50	1	1820	West Kordofan	17-Apr-16	2	2	5	Dextrose + Sftrexone	2	113	25	1	23-Dec-16	0	250
30202	1	330	White Nile	30-Apr-13	2	1	1	Sftrexone + Vancomycin	2		6.3	1	8-May-13	0	8
33543	1	90	White Nile	12-Oct-14	2	1	2	Softx + Dextrose + Sodium	2		3	1	15-Oct-14	0	3
34116	2	1817	White Nile	17-Dec-14	2	1	3	Dextrose + Softrax	2		26	1	18-Dec-14	0	1
35461	2	12	White Nile	11-May-15	2	1	4	Fanko + SoftX	2	40	1.4	1	2-Jun-15	0	22
35587	1	17	White Nile	27-May-15	2	2	4	SoftX + Fanco	2		2	1	18-Jun-15	0	22
32896	1	17	White Nile	25-Jun-14	2	1	4	Fanko + SoftX	2		2.7	1	2-Jul-14	0	7
35607	1	18	White Nile	29-May-15	2	1	4	Softx + Fanco + Dextrose	2	44	2.4	1	4-Jun-15	0	6
36638	1	18	White Nile	13-Oct-15	2	1	4	SoftX + Fanco + Canola	2	45	2.3	1	30-Oct-15	0	17
38834	1	3	White Nile	28-Jul-16	2	1	4	SoftX + Fanco	2			1	2-Aug-16	0	5
30679	2	32	White Nile	30-Jun-12	2	1	4	Softx + Dextrose	2		1.6	2	1-Aug-13	0	397
27144	1	6	White Nile	1-Sep-12	2	1	4	Penicillin + Sftax	2	50	2.9	1	16-Sep-12	0	15
31412	1	7	White Nile	25-Apr-13	2	1	4	Phenytoin + Sftax + Fanco	2	57	2.6	1	30-Oct-13	0	188
32910	2	1820	White Nile	26-Jun-14	2	1	5	Samsung + sftax + morphine	2	120	18	2	13-Oct-14	0	109
57	2	1810	White Nile	26-Jun-14	2	1	5	Samsung + sftax + morphine	2	113	25	2	3-Dec-16	0	891
153	2	1080	White Nile	17-Dec-14	2	1	3	Dextrose + Softrax	2	95	13	1	18-Dec-14	0	1
175	2	1815	White Nile	17-Dec-14	2	1	3	Dextrose + Softrax	2	113	25	1	18-Apr-15	0	122
191	2	365	White Nile	30-Apr-13	2	1	1	Sftrexone + Vancomycin	2	35	3	1	11-Mar-16	0	1046
32726	2	6	Yarmouk University	28-May-14	2	2	4	Fanko + SoftX	2	37	1.2	1	17-Jun-14	1	20
37234	1	450	Zalingei-Central Darfur	29-Dec-15	2	2	5	Sftrexone + Vancomycin	2	84	13	1	4-Jan-16	0	6