

存活分析 (Survival Analysis)

台北大學 統計系 碩士班 學士班

林建甫

C.F. Jeff Lin, MD, PhD

台北大學統計系助理教授

e-mail: cflin@mail.ntpu.edu.tw

<http://web.ntpu.edu.tw/~cflin>

Fall, 2008

- Classroom: 商學大樓 7F01
- Time: Friday, 9:10am–12:00noon
- email: cflin@mail.ntpu.edu.tw
- Class Home Page: <http://web.ntpu.edu.tw/~cflin> → 教學 → 存活分析
- Textbook and References:
 1. **Textbook:** 林建甫, 存活分析, 2008, (雙葉書局).
 2. **Recommend:** John P. Klein and Melvin L. Moeschberger (2003), *Survival Analysis, Technique for Censored and Truncated Data*, 2nd ed., Springer-Verlag, New York. (滄海書局), 碩士班 學士班
 3. **Recommend:** J. D. Kalbfleisch and R. L. Prentice (2002), *The Statistical Analysis of Failure Time Data*, 2nd ed., John Wiley and Son, New York. (雙葉書局), 碩士班
- Software: R 與 SAS.
- 助教:

鄭茹茵 s79633122@webmail.ntpu.edu.tw
趙百筠 cklbc@hotmail.com
- Office Hours:

三峽: Friday 8:00am–9:00am;
三峽: Wednesday, 12:00noon–1:00pm,
台北: Thursday 4:00–6:00pm.
- e-mail 注意事項: 任何電子郵件送到教師與助教, 必須附上科系, 學號, 姓名, 違反學生無法得到任何回應. 請申請學校電子郵件信箱, 盡量避免使用 YAHOO 電子郵件信箱.
- Evaluation
 - Assignment: one HW per week, in LaTeX and PDF format (two files)
 - Mid-term Exam and Final Projects: in LaTeX and PDF format (two files)
 - Review a Special Topic and Presentation

1. 存活分析

在醫學研究中, 存活時間資料為一種常見的研究資料, 例如病患從診斷出癌症到死亡之間的存活時間. 本書主要目的是討論一些常用來分析存活時間的方法, 在醫學統計中, 這些方法常稱為存活分析. 一般而言, 存活分析方法是用來研究或分析樣本所觀測到的某一段時間長度之分配. 一段時間長度通常是從一特定事件起始之起始時間點算起, 計算到某一特定事件發生的時間點為止, 通常稱為事件時間或存活時間. 事件時間的資料出現在不同領域中, 譬如醫學中的癌症存活率; 公共衛生中的死亡率; 流行病學中的生命量表; 保險統計學及人口統計學中的生命統計資料; 工程學中的可靠度分析; 社會學中的事件歷史分析, 研究結婚時間到離婚時間, 到再婚時間, 人口居住時間與流動時間; 商業研究中, 市場研究之消費者對特定商品購買時間, 客戶忠誠度的時間; 公司企業的存活時間; 經濟研究中的失業, 從就業時間到失業時間, 到再就業時間等; 法學研究中, 犯罪嫌疑人從犯罪時間到被捕時間, 犯罪嫌疑人從被捕時間到起訴時間, 從起訴時間到定罪時間, 從假釋時間到再犯時間等.

在醫學研究中, 常常收集病患從診斷出癌症到死亡之間的存活時間, 但是, 並非所有進入研究的觀察對象, 其被追蹤的時間都足夠長, 所以研究者並不能夠觀察到所有研究對象最後的結果, 及所有發生死亡事件時間點. 這樣的資料通常稱為設限資料. 此外, 病患常常具有一些危險因子, 進而影響存活的機會; 但是, 許多影響事件之發生或影響存活時間長短的危險因子, 是在追蹤的時間內才發生, 稱為時間相依危險因子, 這樣的存活時間資料, 必須要有特殊的統計方法來分析. 這些特殊的統計方法, 通稱為存活分析, 這是一個籠統定義的統計名詞.

2. Goals from This Course

Survival Analysis is a complete course covering both the theory and practice of survival methodology. Here are a few of the skills you will acquire:

- (a) Organize survival data.
- (b) Choose the right time axis.
- (c) Use discrete versus continuous time methods.
- (d) Handle various censoring and truncation.
- (e) Pick the right computer program.
- (f) Testing a model fits the data.
- (g) Deal with nonproportionality.
- (h) Manage the unobserved heterogeneity.
- (i) What to do if there is more than one kind of event.

You should have a knowledge of **regression analysis, analysis of variance (design of experiments), categorical data analysis, mathematical statistics**, as well as **elementary biostatistics**.

3. Course Outlines

- Chapter 01 – Chapter 14 + Appendix + Special Topics: Chapter 15 – Chapter 19
- C01 Introduction to Survival Data
- C02 Survival Function, Censoring and Truncation
- C03 Parametric Models
- C04 Nonparametric Models: Single Sample
- C05 Nonparametric Models: Two or More Samples
- C06 Semiparametric Models: Cox Proportional Hazard Models
- C07 Extend Cox Semiparametric Models
- C08 Semiparametric Models: Diagnosis
- C09 Truncation and Interval Censoring
- C10 Introduction to Multivariate Survival Analysis
- C11 Clustered Data: Marginal Models
- C12 Clustered Data: Frailty Models
- C13 Recurrent Events: Marginal Models
- C14 Recurrent Events: Frailty Models
- C15 Multi-state Models
- C16 Competing Risk Models
- C17 Additive Risk Model
- C18 Population-Based Survival and Relative Survival Analysis
- C19 Bayesian Survival Analysis
- Appendix: Introduction to Counting Process

References

- [1] **Recommend:** J. D. Kalbfleisch and R. L. Prentice (2002), *The Statistical Analysis of Failure Time Data*, 2nd ed., John Wiley and Son, New York. (雙葉書局)
- [2] **Recommend:** John P. Klein and Melvin L. Moeschberger (2003), *Survival Analysis, Technique for Censored and Truncated Data*, 2nd ed., Springer-Verlag, New York. (滄海書局)
- [3] D. R. Cox and D. Oakes (1984), *Analysis of Survival Data*, Chapman and Hall, New York. (not available in Taiwan)
- [4] Rupert G. Miller, Jr. (1975), *Survival Analysis*, John Wiley and Son, New York. (not available in Taiwan)
- [5] T. Therneau and P Grambsch (2000), *Modeling Survival Data*, Springer-Verlag, New York. (not available in Taiwan)
- [6] Philip Hougaard (2000), *Analysis of Multivariate Survival Data*, Springer-Verlag, New York. (not available in Taiwan)
- [7] T. R. Fleming and D. P. Harrington (1991), *Counting Processes and Survival Analysis*, John Wiley and Son, New York. (not available in Taiwan)
- [8] Per K. Andersen, Ornulf Borgan, Richard D. Gill, Niels Keiding (1993), *Statistical Models Based on Counting Processes*, Springer-Verlag, New York. (not available in Taiwan)
- [9] P. D. Allison (1995), *Survival Analysis Using the SAS System*, SAS Institute, Carry NC. (not available in Taiwan)
- [10] Alan Cantor (2993), *SAS Survival Analysis Techniques for Medical Research*, Second Edition, SAS Institute, Carry NC. (not available in Taiwan)
- [11] M. Tableman and J. S. Kim (2003), *Survival Analysis Using S: Analysis of Time-to-Event Data*, Chapman and Hall, New York. (not available in Taiwan)
- [12] D. Collett (2003), *Modeling Survival Data in Medical Research*, 2nd ed., Chapman and Hall, New York. (not available in Taiwan)
- [13] J. F. Lawless (2002), *Statistical Models and Methods for Lifetime Data.*, 2nd ed., John Wiley and Son, New York.
- [14] Elisa T. Lee, John Wenyu Wang (2003), *Statistical Methods for Survival Data Analysis*, 3rd Edition, John Wiley and Son, New York.
- [15] Chap T. Le (1997), *Applied Survival Analysis*, John Wiley and Son, New York.
- [16] D. W. Hosmer, Jr. and S. Lemeshow (2003), *Applied Survival Analysis: Regression Modeling of Time to Event Data*, 2nd ed., John Wiley and Son, New York.
- [17] David G. Kleinbaum and Mitchel Klein (2005), *Survival Analysis: A Self-Learning Text*, 2nd ed., Springer-Verlag, New York. (滄海書局).