



# Longitudinal Data Analysis

**Judith D. Singer, John B. Willett**



## **Longitudinal Data Analysis:**

Practical Longitudinal Data Analysis David J. Hand, 2017-10-06 This text describes regression based approaches to analyzing longitudinal and repeated measures data. It emphasizes statistical models, discusses the relationships between different approaches, and uses real data to illustrate practical applications. It uses commercially available software when it exists and illustrates the program code and output. The data appendix provides many real data sets beyond those used for the examples, which can serve as the basis for exercises.

*Applied Longitudinal Analysis* Garrett M. Fitzmaurice, Nan M. Laird, James H. Ware, 2012-10-23 Praise for the First Edition: this book should be on the shelf of everyone interested in longitudinal data analysis. Journal of the American Statistical Association. Features newly developed topics and applications of the analysis of longitudinal data. *Applied Longitudinal Analysis* Second Edition presents modern methods for analyzing data from longitudinal studies and now features the latest state of the art techniques. The book emphasizes practical rather than theoretical aspects of methods for the analysis of diverse types of longitudinal data that can be applied across various fields of study from the health and medical sciences to the social and behavioral sciences. The authors incorporate their extensive academic and research experience along with various updates that have been made in response to reader feedback. The Second Edition features six newly added chapters that explore topics currently evolving in the field including Fixed effects and mixed effects models, Marginal models and generalized estimating equations, Approximate methods for generalized linear mixed effects models, Multiple imputation and inverse probability weighted methods, Smoothing methods for longitudinal data, Sample size and power. Each chapter presents methods in the setting of applications to data sets drawn from the health sciences. New problem sets have been added to many chapters and a related website features sample programs and computer output using SAS, Stata, and R as well as data sets and supplemental slides to facilitate a complete understanding of the material. With its strong emphasis on multidisciplinary applications and the interpretation of results, *Applied Longitudinal Analysis* Second Edition is an excellent book for courses on statistics in the health and medical sciences at the upper undergraduate and graduate levels. The book also serves as a valuable reference for researchers and professionals in the medical, public health, and pharmaceutical fields as well as those in social and behavioral sciences who would like to learn more about analyzing longitudinal data.

Applied Longitudinal Data Analysis Judith D. Singer, John B. Willett, 2003-03-27 Change is constant in everyday life. Infants crawl and then walk, children learn to read and write, teenagers mature in myriad ways, the elderly become frail and forgetful. Beyond these natural processes and events, external forces and interventions instigate and disrupt change: test scores may rise after a coaching course, drug abusers may remain abstinent after residential treatment. By charting changes over time and investigating whether and when events occur, researchers reveal the temporal rhythms of our lives. *Applied Longitudinal Data Analysis* is a much needed professional book for empirical researchers and graduate students in the behavioral, social, and biomedical sciences. It offers the first accessible in depth

presentation of two of today's most popular statistical methods: multilevel models for individual change and hazard survival models for event occurrence in both discrete and continuous time. Using clear, concise prose and real data sets from published studies, the authors take you step by step through complete analyses from simple exploratory displays that reveal underlying patterns through sophisticated specifications of complex statistical models. **Applied Longitudinal Data Analysis** offers readers a private consultation session with internationally recognized experts and represents a unique contribution to the literature on quantitative empirical methods. Visit <http://www.ats.ucla.edu/stat/examples/alda/htm> for Downloadable data sets, Library of computer programs in SAS, SPSS, Stata, HLM, MLwiN and more. Additional material for data analysis.

**Quantitative Longitudinal Data Analysis** Vernon Gayle, Paul Lambert, 2020-12-10. First published. Open Access under a Creative Commons license. As **What is Quantitative Longitudinal Data Analysis**, this title is now also available as part of the Bloomsbury Research Methods series. Across the social sciences, there is widespread agreement that quantitative longitudinal research designs offer analysts powerful scientific data resources. But to date, many texts on analysing longitudinal social analysis surveys have been written from a statistical rather than a social science data analysis perspective and they lack adequate coverage of common practical challenges associated with social science data analyses. This book provides a practical and up-to-date introduction to influential approaches to quantitative longitudinal data analysis in the social sciences. The book introduces definitions and terms, explains the relative attractions of such a longitudinal design and offers an introduction to the main techniques of analysis, explaining their requirements, statistical properties and their substantive contribution.

**Longitudinal Data Analysis** Garrett Fitzmaurice, Marie Davidian, Geert Verbeke, Geert Molenberghs, 2008-08-11. Although many books currently available describe statistical models and methods for analyzing longitudinal data, they do not highlight connections between various research threads in the statistical literature. Responding to this void, **Longitudinal Data Analysis** provides a clear, comprehensive and unified overview of state-of-the-art theory.

**Analysis of Longitudinal Data** Peter Diggle, Patrick Heagerty, Kung-Yee Liang, Scott Zeger, 2013-03-14. The first edition of **Analysis of Longitudinal Data** has become a classic. Describing the statistical models and methods for the analysis of longitudinal data, it covers both the underlying statistical theory of each method and its application to a range of examples from the agricultural and biomedical sciences. The main topics discussed are design issues, exploratory methods of analysis, linear models for continuous data, general linear models for discrete data and models and methods for handling data and missing values. Under each heading, worked examples are presented in parallel with the methodological development and sufficient detail is given to enable the reader to reproduce the author's results using the data sets as an appendix. This second edition, published for the first time in paperback, provides a thorough and expanded revision of this important text. It includes two new chapters: the first discusses fully parametric models for discrete repeated measures data and the second explores statistical models for time-dependent predictors.

**Applied Longitudinal Data Analysis for Medical Science** Jos W. R.

Twisk,2023-04-27 Essential for non statisticians and researchers working with longitudinal data from medical studies this updated new edition discusses the most important techniques available for analysing data of this type Using non technical language the book explores simple methods such as the paired t test and summary statistics as well as more sophisticated regression based methods including mixed model analysis The emphasis of the discussion lies in the interpretation of the results of these different methods covering data analysis with continuous dichotomous categorical and other outcome variables Datasets used throughout the book are provided enabling readers to re analyse the examples as they make their way through chapters and improve their understanding of the material Finally an extensive and practical overview of and comparison between different software packages is provided Readers will be able to use this book as a practical manual in their everyday work without needing a strong background in statistics

**Applied Longitudinal Data Analysis for Epidemiology** Jos W. R. Twisk,2003-03-27 In this book the most important techniques available for longitudinal data analysis are discussed This discussion includes simple techniques such as the paired t test and summary statistics but also more sophisticated techniques such as generalised estimating equations and random coefficient analysis A distinction is made between longitudinal analysis with continuous dichotomous and categorical outcome variables It should be stressed that the emphasis of the discussion lies on the interpretation of the different techniques and on the comparison of the results of different techniques Furthermore special chapters will deal with the analysis of two measurements experimental studies and the problem of missing data in longitudinal studies Finally an extensive overview of and a comparison between different software packages is provided It is important to realise that this book is a practical guide and especially suitable for non statisticians

**A Primer in Longitudinal Data Analysis** Toon W Taris,2000-05-25 The author has done a remarkable job of writing a very accessible introduction to a broad literature As such he should be congratulated on achieving his objective to provide the ideal primer for this growing area of social research Kwantitatieve Methoden This accessible introduction to the theory and practice of longitudinal research takes the reader through the strengths and weaknesses of this kind of research making clear how to design a longitudinal study how to collect data most effectively how to make the best use of statistical techniques and how to interpret results Although the book provides a broad overview of the field the focus is always on the practical issues arising out of longitudinal research This book supplies the student with all that they need to get started and acts as a manual for dealing with opportunities and pitfalls It is the ideal primer for this growing area of social research

*Longitudinal Data Analysis* Jason Newsom,Richard N. Jones,Scott M. Hofer,2013-06-19 This book provides accessible treatment to state of the art approaches to analyzing longitudinal studies Comprehensive coverage of the most popular analysis tools allows readers to pick and choose the techniques that best fit their research The analyses are illustrated with examples from major longitudinal data sets including practical information about their content and design Illustrations from popular software packages offer tips on how to interpret the results Each chapter features suggested

readings for additional study and a list of articles that further illustrate how to implement the analysis and report the results Syntax examples for several software packages for each of the chapter examples are provided at [www.psypress.com](http://www.psypress.com)

longitudinal data analysis Although many of the examples address health or social science questions related to aging readers from other disciplines will find the analyses relevant to their work In addition to demonstrating statistical analysis of longitudinal data the book shows how to interpret and analyze the results within the context of the research design The methods covered in this book are applicable to a range of applied problems including short to long term longitudinal studies using a range of sample sizes The book provides non technical practical introductions to the concepts and issues relevant to longitudinal analysis Topics include use of publicly available data sets weighting and adjusting for complex sampling designs with longitudinal studies missing data and attrition measurement issues related to longitudinal research the use of ANOVA and regression for average change over time mediation analysis growth curve models basic and advanced structural equation models and survival analysis An ideal supplement for graduate level courses on data analysis and or longitudinal modeling taught in psychology gerontology public health human development family studies medicine sociology social work and other behavioral social and health sciences this multidisciplinary book will also appeal to researchers in these fields

**Modeling Longitudinal Data** Robert E. Weiss, 2005-06-28 The book features many figures and tables illustrating longitudinal data and numerous homework problems The associated web site contains many longitudinal data sets examples of computer code and labs to re enforce the material Weiss emphasizes continuous data rather than discrete data graphical and covariance methods and generalizations of regression rather than generalizations of analysis of variance

Methods and Applications of Longitudinal Data Analysis Xian Liu, 2015-09-01 Methods and Applications of Longitudinal Data Analysis describes methods for the analysis of longitudinal data in the medical biological and behavioral sciences It introduces basic concepts and functions including a variety of regression models and their practical applications across many areas of research Statistical procedures featured within the text include descriptive methods for delineating trends over time linear mixed regression models with both fixed and random effects covariance pattern models on correlated errors generalized estimating equations nonlinear regression models for categorical repeated measurements techniques for analyzing longitudinal data with non ignorable missing observations Emphasis is given to applications of these methods using substantial empirical illustrations designed to help users of statistics better analyze and understand longitudinal data Methods and Applications of Longitudinal Data Analysis equips both graduate students and professionals to confidently apply longitudinal data analysis to their particular discipline It also provides a valuable reference source for applied statisticians demographers and other quantitative methodologists From novice to professional this book starts with the introduction of basic models and ends with the description of some of the most advanced models in longitudinal data analysis Enables students to select the correct statistical methods to apply to their longitudinal data and avoid the pitfalls associated with incorrect selection Identifies the

limitations of classical repeated measures models and describes newly developed techniques along with real world examples

**Models for Intensive Longitudinal Data** Theodore A. Walls, Joseph L. Schafer, 2006-01-19 Rapid technological advances in devices used for data collection have led to the emergence of a new class of longitudinal data intensive longitudinal data (ILD). Behavioral scientific studies now frequently utilize handheld computers, beepers, web interfaces and other technological tools for collecting many more data points over time than previously possible. Other protocols such as those used in fMRI and monitoring of public safety also produce ILD; hence the statistical models in this volume are applicable to a range of data. The volume features state-of-the-art statistical modeling strategies developed by leading statisticians and methodologists working on ILD in conjunction with behavioral scientists. Chapters present applications from across the behavioral and health sciences including coverage of substantive topics such as stress, smoking cessation, alcohol use, traffic patterns, educational performance and intimacy. **Models for Intensive Longitudinal Data (MILD)** is designed for those who want to learn about advanced statistical models for intensive longitudinal data and for those with an interest in selecting and applying a given model. The chapters highlight issues of general concern in modeling these kinds of data such as a focus on regulatory systems, issues of curve registration, variable frequency and spacing of measurements, complex multivariate patterns of change and multiple independent series. The extraordinary breadth of coverage makes this an indispensable reference for principal investigators designing new studies that will introduce ILD, applied statisticians working on related models and methodologists, graduate students and applied analysts working in a range of fields. A companion Web site at [www.oup.com/us/MILD](http://www.oup.com/us/MILD) contains program examples and documentation. *Longitudinal Data Analysis* Donald Hedeker, Robert D. Gibbons, 2012-07-06 This book presents and describes methods for analysis of longitudinal data with a strong emphasis on the application of these methods to problems in the biomedical and behavioral sciences. This is an important book because longitudinal data are increasingly common in many areas of research and methods of analysis of such data are not well understood by data analysts. Therefore the book is geared more toward users and not developers of statistics. The Second Edition features six new chapters on Bivariate and Multivariate Models, Growth Mixture Models, Grouped and Discrete Time Survival Analysis Models, Mixed effects Regression Models for Higher Level Data, Intensive Longitudinal Data and Sample Size and Power Determination in Longitudinal Studies. In addition the introductory chapter now describes the pertinent features of each presented dataset in an effort to streamline the presentation of the datasets. The relevant variables of the datasets and the scientific aim of the studies are described. Specific statistical procedures covered within the book include repeated measures analysis of variance, multivariate analysis of variance for repeated measures, random effects regression models, RRM covariance structure models, generalized estimating equations (GEE) models and generalizations of RRM and GE for categorical outcomes. This book emphasizes methods for analysis of longitudinal data analysis which are extensively illustrated using real examples. The authors have chosen not to focus on software in the book.

though some syntax examples are provided Many programs are available for the analyses presented in this book including SAS SPSS SYSTAT HLM MLwiN MIXREG MIXOR and Mplus Several datasets and computer syntax examples are posted on the book's related website It is the aim of the authors to keep these syntax examples current as new versions of the software programs emerge **What is Quantitative Longitudinal Data Analysis?** Vernon Gayle, Paul Lambert, 2020

Longitudinal Analysis Lesa Hoffman, 2015-01-30 Longitudinal Analysis provides an accessible application oriented treatment of introductory and advanced linear models for within person fluctuation and change Organized by research design and data type the text uses in depth examples to provide a complete description of the model building process The core longitudinal models and their extensions are presented within a multilevel modeling framework paying careful attention to the modeling concerns that are unique to longitudinal data Written in a conversational style the text provides verbal and visual interpretation of model equations to aid in their translation to empirical research results Overviews and summaries boldfaced key terms and review questions will help readers synthesize the key concepts in each chapter Written for non mathematically oriented readers this text features A description of the data manipulation steps required prior to model estimation so readers can more easily apply the steps to their own data An emphasis on how the terminology interpretation and estimation of familiar general linear models relates to those of more complex models for longitudinal data Integrated model comparisons effect sizes and statistical inference in each example to strengthen readers understanding of the overall model building process Sample results sections for each example to provide useful templates for published reports Examples using both real and simulated data in the text along with syntax and output for SPSS SAS STATA and Mplus at [www.PilesOfVariance.com](http://www.PilesOfVariance.com) to help readers apply the models to their own data The book opens with the building blocks of longitudinal analysis general ideas the general linear model for between person analysis and between and within person models for the variance and the options within repeated measures analysis of variance Section 2 introduces unconditional longitudinal models including alternative covariance structure models to describe within person fluctuation over time and random effects models for within person change Conditional longitudinal models are presented in section 3 including both time invariant and time varying predictors Section 4 reviews advanced applications including alternative metrics of time in accelerated longitudinal designs three level models for multiple dimensions of within person time the analysis of individuals in groups over time and repeated measures designs not involving time The book concludes with additional considerations and future directions including an overview of sample size planning and other model extensions for non normal outcomes and intensive longitudinal data Class tested at the University of Nebraska Lincoln and in intensive summer workshops this is an ideal text for graduate level courses on longitudinal analysis or general multilevel modeling taught in psychology human development and family studies education business and other behavioral social and health sciences The book's accessible approach will also help those trying to learn on their own Only familiarity with general linear models regression analysis of



variance is needed for this text

**What is Quantitative Longitudinal Data Analysis?** Vernon Gayle, Paul Lambert (Lecturer), 2017 Across the social sciences there is widespread agreement that quantitative longitudinal research designs offer analysts powerful scientific data resources. But to date most texts on social survey analysis have been written from a statistical rather than a social science data analysis perspective and they lack adequate coverage of common practical challenges. This book aims to provide a practical and up to date introduction to influential approaches to quantitative longitudinal data analysis in the social sciences. The book will discuss definitions and terms, explain the relative attractions of such a design and enumerate in an accessible way the main techniques of analysis, explaining their requirements, statistical properties and their substantive contribution. The book is designed for postgraduates and researchers across the social sciences considering the use of quantitative longitudinal data resources in their research. It will also be an excellent text for undergraduate and postgraduate courses on advanced quantitative methods. Bloomsbury Publishing

**Models for Discrete Longitudinal Data** Geert Molenberghs, Geert Verbeke, 2006-01-28 The linear mixed model has become the main parametric tool for the analysis of continuous longitudinal data as the authors discussed in their 2000 book. Without putting too much emphasis on software, the book shows how the different approaches can be implemented within the SAS software package. The authors received the American Statistical Association's Excellence in Continuing Education Award based on short courses on longitudinal and incomplete data at the Joint Statistical Meetings of 2002 and 2004.

**Longitudinal Data Analysis for the Behavioral Sciences Using R** Jeffrey D. Long, 2011-10-31 This book is unique in its focus on showing students in the behavioral sciences how to analyze longitudinal data using R software. The book focuses on application, making it practical and accessible to students in psychology, education and related fields who have a basic foundation in statistics. It provides explicit instructions in R computer programming throughout the book, showing students exactly how a specific analysis is carried out and how output is interpreted.

Longitudinal Data Analysis Ikuko Funatogawa, Takashi Funatogawa, 2019-02-04 This book provides a new analytical approach for dynamic data repeatedly measured from multiple subjects over time. Random effects account for differences across subjects. Auto regression in response itself is often used in time series analysis. In longitudinal data analysis, a static mixed effects model is changed into a dynamic one by the introduction of the auto regression term. Response levels in this model gradually move toward an asymptote or equilibrium which depends on covariates and random effects. The book provides relationships of the autoregressive linear mixed effects models with linear mixed effects models, marginal models, transition models, nonlinear mixed effects models, growth curves, differential equations and state space representation. State space representation with a modified Kalman filter provides log likelihoods for maximum likelihood estimation and this representation is suitable for unequally spaced longitudinal data. The extension to multivariate longitudinal data analysis is also provided. Topics in medical fields such as response dependent dose modifications, response dependent dropouts and randomized controlled trials are discussed. The text is written in plain terms.

understandable for researchers in other disciplines such as econometrics sociology and ecology for the progress of interdisciplinary research

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## **Table of Contents Longitudinal Data Analysis**

1. Understanding the eBook Longitudinal Data Analysis
  - The Rise of Digital Reading Longitudinal Data Analysis
  - Advantages of eBooks Over Traditional Books
2. Identifying Longitudinal Data Analysis
  - Exploring Different Genres
  - Considering Fiction vs. Non-Fiction
  - Determining Your Reading Goals
3. Choosing the Right eBook Platform
  - Popular eBook Platforms
  - Features to Look for in an Longitudinal Data Analysis
  - User-Friendly Interface
4. Exploring eBook Recommendations from Longitudinal Data Analysis
  - Personalized Recommendations
  - Longitudinal Data Analysis User Reviews and Ratings
  - Longitudinal Data Analysis and Bestseller Lists

5. Accessing Longitudinal Data Analysis Free and Paid eBooks
  - Longitudinal Data Analysis Public Domain eBooks
  - Longitudinal Data Analysis eBook Subscription Services
  - Longitudinal Data Analysis Budget-Friendly Options
6. Navigating Longitudinal Data Analysis eBook Formats
  - ePub, PDF, MOBI, and More
  - Longitudinal Data Analysis Compatibility with Devices
  - Longitudinal Data Analysis Enhanced eBook Features
7. Enhancing Your Reading Experience
  - Adjustable Fonts and Text Sizes of Longitudinal Data Analysis
  - Highlighting and Note-Taking Longitudinal Data Analysis
  - Interactive Elements Longitudinal Data Analysis
8. Staying Engaged with Longitudinal Data Analysis
  - Joining Online Reading Communities
  - Participating in Virtual Book Clubs
  - Following Authors and Publishers Longitudinal Data Analysis
9. Balancing eBooks and Physical Books Longitudinal Data Analysis
  - Benefits of a Digital Library
  - Creating a Diverse Reading Collection Longitudinal Data Analysis
10. Overcoming Reading Challenges
  - Dealing with Digital Eye Strain
  - Minimizing Distractions
  - Managing Screen Time
11. Cultivating a Reading Routine Longitudinal Data Analysis
  - Setting Reading Goals Longitudinal Data Analysis
  - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Longitudinal Data Analysis
  - Fact-Checking eBook Content of Longitudinal Data Analysis
  - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

### 14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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