

applied longitudinal analysis

Applied Longitudinal Analysis: A Comprehensive Guide

Introduction:

Are you grappling with data that unfolds over time? Do you need to understand how variables change and interact dynamically across multiple measurements? Then you need to understand applied longitudinal analysis. This comprehensive guide dives deep into the world of longitudinal data analysis, explaining its core principles, various techniques, and practical applications. We'll equip you with the knowledge to effectively analyze longitudinal data, interpret your results, and draw meaningful conclusions – boosting your research prowess and making your data sing. This post covers everything from choosing the right analysis method to interpreting your findings, making it the ultimate resource for researchers, students, and anyone working with time-series data.

1. Understanding Longitudinal Data and its Uniqueness

Longitudinal data, unlike cross-sectional data, involves repeated observations of the same subjects over a defined period. This repeated measurement allows us to capture the dynamic nature of phenomena, revealing trends, changes, and individual trajectories that static snapshots simply can't show. This crucial difference makes longitudinal data powerful for understanding processes of change and development across various fields, including medicine, psychology, sociology, and economics. For instance, tracking the blood pressure of patients over several years provides a far richer understanding of hypertension management than a single measurement. Similarly, studying cognitive development requires repeated assessments to capture the nuances of learning and aging. Understanding the inherent strengths and challenges of longitudinal data is the first critical step towards effective analysis. These challenges include attrition (loss of participants over time), time-varying confounders, and the need for specialized statistical techniques.

2. Choosing the Right Analytical Approach

The choice of analytical approach depends heavily on the research question, the nature of the data (continuous, categorical, etc.), and the assumptions that can be reasonably met. Several techniques fall under the umbrella of applied longitudinal analysis, each with its strengths and weaknesses:

Linear Mixed-Effects Models (LMEMs): These are incredibly versatile and popular for analyzing longitudinal data with continuous outcomes. LMEMs account for both within-subject and between-subject variability, making them ideal for examining individual trajectories and group differences. They handle missing data relatively well and allow for the incorporation of time-varying and time-invariant predictors.

Generalized Linear Mixed-Effects Models (GLMMs): Extensions of LMEMs, GLMMs are designed for non-normal outcomes such as binary (yes/no), count (number of events), or ordinal data. They offer flexibility in modeling a wider range of dependent variables.

Growth Curve Modeling (GCM): This technique focuses on modeling individual change over time, often represented by polynomial functions. GCM is particularly useful for exploring patterns of growth or decline and for identifying factors that influence these patterns.

Survival Analysis: When the outcome is time-to-event data (e.g., time until death, time until relapse), survival analysis techniques are appropriate. These methods account for censoring (when the event of interest hasn't occurred by the end of the study).

Time Series Analysis: For densely sampled data, time series analysis methods can be applied to identify patterns, trends, and seasonality within the data. This approach is often used in economics and finance.

The selection of the appropriate method requires careful consideration of the research objectives and the characteristics of the dataset. Incorrect model selection can lead to biased or misleading results.

3. Addressing Challenges in Longitudinal Analysis

Longitudinal studies often encounter several challenges that require careful handling:

Attrition: Participants dropping out of the study over time can introduce bias if the attrition is not random. Strategies for addressing attrition include multiple imputation and inverse probability weighting.

Missing Data: Missing data is a common problem in longitudinal studies. Appropriate handling of missing data is crucial to avoid bias. Methods such as imputation and maximum likelihood estimation can be used.

Time-Varying Confounders: Variables that change over time and are associated with both the predictor and the outcome can confound the results. Careful consideration of potential confounders and appropriate statistical adjustments are necessary.

Autocorrelation: Repeated measurements from the same individual are likely to be correlated. Ignoring this autocorrelation can lead to inflated Type I error rates. Longitudinal models, such as LMEMs, explicitly account for this correlation.

4. Interpreting Results and Drawing Meaningful Conclusions

Once the analysis is complete, the critical step is interpreting the results in the context of the research question and the study design. This involves understanding the estimated effects of the predictors, their statistical significance, and the confidence intervals. Visualizations, such as graphs showing individual trajectories or group means over time, are essential for communicating the findings effectively. It's crucial to avoid overinterpreting statistically significant results and to acknowledge limitations of the study. Robust conclusions require a thorough understanding of both the statistical output and the practical implications of the findings.

5. Software and Tools for Longitudinal Analysis

Several statistical software packages offer capabilities for longitudinal analysis. The most popular include:

R: A powerful and versatile open-source software with numerous packages specifically designed for longitudinal analysis (e.g., `lme4`, `nlme`, `geepack`).

SAS: A comprehensive statistical software package with extensive capabilities for longitudinal data analysis.

SPSS: A user-friendly software package that also provides tools for conducting longitudinal analyses.

Stata: Another widely used statistical software with strong capabilities in longitudinal data analysis.

Choosing the right software depends on your familiarity with the software, the complexity of your analysis, and the availability of resources.

Example Book Outline: "Applied Longitudinal Analysis: A Practical Guide"

Introduction:

What is longitudinal analysis?

Why use longitudinal analysis?

Types of longitudinal data

Overview of the book

Chapter 1: Fundamentals of Longitudinal Data:

Defining longitudinal data and its characteristics.

Key concepts: time-invariant and time-varying covariates.

Different types of longitudinal data structures.

Dealing with missing data.

Chapter 2: Linear Mixed-Effects Models (LMEMs):

Introduction to LMEMs.

Model specification and interpretation.

Model diagnostics and assumptions.

Software implementation in R and SAS.

Chapter 3: Generalized Linear Mixed-Effects Models (GLMMs):

Extending LMEMs to non-normal data.

Model specification for different outcome types.

Interpretation of GLMM results.

Chapter 4: Growth Curve Modeling:

Introduction to growth curve modeling.

Model specification and interpretation.

Applications of growth curve modeling.

Chapter 5: Advanced Topics in Longitudinal Analysis:

Dealing with complex data structures.

Addressing attrition and missing data.

Handling time-varying confounders.

Model selection and comparison.

Conclusion:

Summary of key concepts.

Future directions in longitudinal analysis.

Article Explaining Each Point of the Outline:

This section would involve expanding each bullet point from the book outline into a detailed article section of its own. Due to the length constraints of this response, I cannot provide the full expansion of each point, but the above outline should provide a solid framework for such an expansion. Each chapter would cover the concepts in detail with illustrative examples and practical applications.

9 Unique FAQs:

1. What is the difference between cross-sectional and longitudinal studies? Cross-sectional studies examine a single point in time, while longitudinal studies follow the same subjects over time.
1. What are the advantages of using longitudinal analysis? It allows for the study of change over time, identification of risk factors, and examination of causal relationships.
1. What are some common challenges in longitudinal analysis? Attrition, missing data, and time-varying confounders are common challenges.

1. Which statistical software is best for longitudinal analysis? R, SAS, SPSS, and Stata are popular choices, each with strengths and weaknesses.

1. How do I choose the appropriate analytical technique? The choice depends on the research question, the type of outcome variable, and the assumptions that can be reasonably met.

1. How do I interpret the results of a longitudinal analysis? Interpret the estimated effects, their statistical significance, and confidence intervals within the context of the research question and study limitations.

1. What is the role of visualization in longitudinal analysis? Visualizations, such as plots of individual trajectories or group means, help communicate the results effectively.

1. What is the impact of attrition on longitudinal study results? Attrition can introduce bias if not addressed appropriately. Methods like imputation or weighting can help mitigate this bias.

1. How do I handle time-varying confounders in my longitudinal analysis? Include them as covariates in the model to adjust for their influence.

9 Related Articles:

1. Introduction to Mixed-Effects Models: A beginner's guide to understanding the fundamentals of mixed-effects models.
2. Growth Mixture Modeling: Exploring heterogeneous trajectories using growth mixture models.
3. Handling Missing Data in Longitudinal Studies: Strategies for dealing with missing data in longitudinal datasets.
4. Longitudinal Data Analysis in R: A practical tutorial on performing longitudinal analyses in R.
5. Longitudinal Analysis in Clinical Trials: Applications of longitudinal analysis in the context of clinical trials.
6. Analyzing Repeated Measures Data: A comparison of different approaches to analyzing repeated measures data.
7. Time Series Analysis for Forecasting: Using time series methods to predict future outcomes.
8. Survival Analysis Techniques: An overview of different survival analysis methods and their applications.
9. Interpreting Coefficients in Mixed-Effects Models: A detailed explanation of how to interpret the coefficients in mixed-effects models.

M. Laird, James H. Ware, 2004-07 Publisher Description

applied longitudinal analysis: 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 analysis: 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

applied longitudinal analysis: Applied Longitudinal Data Analysis for Epidemiology Jos W. R. Twisk, 2013-05-09 A practical guide to the most important techniques available for longitudinal data analysis, essential for non-statisticians and researchers.

applied longitudinal analysis: Applied Longitudinal Data Analysis Marie Davidian, 2010-08-01 The goal of this book is to provide an overview of statistical models and methods that are useful in the analysis of longitudinal data; that is, data in the form of repeated measurements on the same experimental unit over time. The intended audience is a combination of non- statistics graduate students who have taken an applied methods course covering linear regression and Analysis of

Variance and masters-level statistics students looking for an applied intro course.

applied longitudinal analysis: *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

applied longitudinal analysis: *Applied Longitudinal Analysis* Garrett M. Fitzmaurice, 2017-07-26 *Applied Longitudinal Analysis* By Garrett M. Fitzmaurice

applied longitudinal analysis: *Applied Longitudinal Data Analysis for Medical Science* Jos W. R. Twisk, 2023-05-31 Discusses methods available for longitudinal data analysis in non-technical language, allowing readers to apply techniques easily to their work. Aimed at non-statisticians and researchers working in medical science and utilising longitudinal studies, the interpretation of the results of various methods of analysis is emphasised.

applied longitudinal analysis: 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.

applied longitudinal analysis: *Analysis of Longitudinal Data* Peter Diggle, Patrick Heagerty, Kung-Yee Liang, Scott Zeger, 2013-03-14 This second edition has been completely revised and expanded to become the most up-to-date and thorough professional reference text in this fast-moving area of biostatistics. It contains an additional two chapters on fully parametric models for discrete repeated measures data and statistical models for time-dependent predictors.

applied longitudinal analysis: *Longitudinal Data Analysis for the Behavioral Sciences Using R* Jeffrey D. Long, 2012 This book is a practical guide for the analysis of longitudinal behavioural data. Longitudinal data consist of repeated measures collected on the same subjects over time.

applied longitudinal analysis: Longitudinal Data Analysis Donald Hedeker, Robert D. Gibbons, 2006-05-12 *Longitudinal data analysis for biomedical and behavioral sciences* This innovative book sets forth and describes methods for the analysis of longitudinal data, emphasizing applications to problems in the biomedical and behavioral sciences. Reflecting the growing importance and use of longitudinal data across many areas of research, the text is designed to help users of statistics better analyze and understand this type of data. Much of the material from the book grew out of a course taught by Dr. Hedeker on longitudinal data analysis. The material is, therefore, thoroughly classroom tested and includes a number of features designed to help readers better understand and apply the material. Statistical procedures featured within the text include: * Repeated measures analysis of variance * Multivariate analysis of variance for repeated measures *

Random-effects regression models (RRM) * Covariance-pattern models * Generalized-estimating equations (GEE) models * Generalizations of RRM and GEE for categorical outcomes Practical in their approach, the authors emphasize the applications of the methods, using real-world examples for illustration. Some syntax examples are provided, although the authors do not generally focus on software in this book. Several datasets and computer syntax examples are posted on this title's companion Web site. The authors intend to keep the syntax examples current as new versions of the software programs emerge. This text is designed for both undergraduate and graduate courses in longitudinal data analysis. Instructors can take advantage of overheads and additional course materials available online for adopters. Applied statisticians in biomedicine and the social sciences can also use the book as a convenient reference.

applied longitudinal analysis: *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/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.

applied longitudinal analysis: Linear Mixed Models for Longitudinal Data Geert Verbeke, Geert Molenberghs, 2009-05-12 This book provides a comprehensive treatment of linear mixed models for continuous longitudinal data. Next to model formulation, this edition puts major emphasis on exploratory data analysis for all aspects of the model, such as the marginal model, subject-specific profiles, and residual covariance structure. Further, model diagnostics and missing data receive extensive treatment. Sensitivity analysis for incomplete data is given a prominent place. Most analyses were done with the MIXED procedure of the SAS software package, but the data analyses are presented in a software-independent fashion.

applied longitudinal analysis: *Advances in Longitudinal Data Methods in Applied Economic Research* Nicholas Tsounis, Aspasia Vlachvei, 2021-03-31 This volume presents new methods and applications in longitudinal data estimation methodology in applied economic. Featuring selected papers from the 2020 the International Conference on Applied Economics (ICOAE 2020) held virtually due to the corona virus pandemic, this book examines interdisciplinary topics such as financial economics, international economics, agricultural economics, marketing and management. Country specific case studies are also featured.

applied longitudinal analysis: *Longitudinal Data Analysis* Professor Catrien C J H C J H Bijleveld, Leo J. Th. van der Kamp, Professor Leo J Th Van Der Kamp, Ab Mooijaart, Dr Willem A Van

Der Van Der Kloot, Dr Rien Van Der Leeden, Eeke Van Der Burg, 1998-10-26 By looking at the processes of change over time - by carrying out longitudinal studies - researchers answer questions about learning, development, educational growth, social change and medical outcomes. However, longitudinal research has many faces. This book examines all the main approaches as well as newer developments (such as structural equation modelling, multilevel modelling and optimal scaling) to enable the reader to gain a thorough understanding of the approach and make appropriate decisions about which technique can be applied to the research problem. Conceptual explanations are used to keep technical terms to a minimum; examples are provided for each approach; issues of design, measurement and significance are considered; and a standard notation is used throughout.

applied longitudinal analysis: 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 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.

applied longitudinal analysis: Modeling Longitudinal Data Robert E. Weiss, 2006-12-06

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.

applied longitudinal analysis: Intensive Longitudinal Methods Niall Bolger, Jean-Philippe

Laurenceau, 2013-01-22 This book offers a complete, practical guide to doing an intensive

longitudinal study with individuals, dyads, or groups. It provides the tools for studying social, psychological, and physiological processes in everyday contexts, using methods such as diary and experience sampling. A range of engaging, worked-through research examples with datasets are featured. Coverage includes how to: select the best intensive longitudinal design for a particular research question, apply multilevel models to within-subject designs, model within-subject change processes for continuous and categorical outcomes, assess the reliability of within-subject changes, assure sufficient statistical power, and more. Several end-of-chapter write-ups illustrate effective ways to present study findings for publication. Datasets and output in SPSS, SAS, Mplus, HLM, MLwiN, and R for the examples are available on the companion website (www.intensivelongitudinal.com).

applied longitudinal analysis: Nonparametric Regression Methods for Longitudinal Data Analysis Hulin Wu, Jin-Ting Zhang, 2006-05-12 Incorporates mixed-effects modeling techniques for more powerful and efficient methods This book presents current and effective nonparametric regression techniques for longitudinal data analysis and systematically investigates the incorporation of mixed-effects modeling techniques into various nonparametric regression models. The authors emphasize modeling ideas and inference methodologies, although some theoretical results for the justification of the proposed methods are presented. With its logical structure and organization, beginning with basic principles, the text develops the foundation needed to master advanced principles and applications. Following a brief overview, data examples from biomedical research studies are presented and point to the need for nonparametric regression analysis approaches. Next, the authors review mixed-effects models and nonparametric regression models, which are the two key building blocks of the proposed modeling techniques. The core section of the book consists of four chapters dedicated to the major nonparametric regression methods: local polynomial, regression spline, smoothing spline, and penalized spline. The next two chapters extend these modeling techniques to semiparametric and time varying coefficient models for longitudinal data analysis. The final chapter examines discrete longitudinal data modeling and analysis. Each chapter concludes with a summary that highlights key points and also provides bibliographic notes that point to additional sources for further study. Examples of data analysis from biomedical research are used to illustrate the methodologies contained throughout the book. Technical proofs are presented in separate appendices. With its focus on solving problems, this is an excellent textbook for upper-level undergraduate and graduate courses in longitudinal data analysis. It is also recommended as a reference for biostatisticians and other theoretical and applied research statisticians with an interest in longitudinal data analysis. Not only do readers gain an understanding of the principles of various nonparametric regression methods, but they also gain a practical understanding of how to use the methods to tackle real-world problems.

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applied longitudinal analysis: Missing Data in Longitudinal Studies Michael J. Daniels, Joseph W. Hogan, 2008-03-11 Drawing from the authors' own work and from the most recent

developments in the field, *Missing Data in Longitudinal Studies: Strategies for Bayesian Modeling and Sensitivity Analysis* describes a comprehensive Bayesian approach for drawing inference from incomplete data in longitudinal studies. To illustrate these methods, the authors employ

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applied longitudinal analysis: *Dynamic Mixed Models for Familial Longitudinal Data* Brajendra C. Sutradhar, 2011-01-27 This book provides a theoretical foundation for the analysis of discrete data such as count and binary data in the longitudinal setup. Unlike the existing books, this book uses a class of auto-correlation structures to model the longitudinal correlations for the repeated discrete data that accommodates all possible Gaussian type auto-correlation models as special cases including the equi-correlation models. This new dynamic modelling approach is utilized to develop theoretically sound inference techniques such as the generalized quasi-likelihood (GQL) technique for consistent and efficient estimation of the underlying regression effects involved in the model, whereas the existing 'working' correlations based GEE (generalized estimating equations) approach has serious theoretical limitations both for consistent and efficient estimation, and the existing random effects based correlations approach is not suitable to model the longitudinal correlations. The book has exploited the random effects carefully only to model the correlations of the familial data. Subsequently, this book has modelled the correlations of the longitudinal data collected from the members of a large number of independent families by using the class of auto-correlation structures conditional on the random effects. The book also provides models and inferences for discrete longitudinal data in the adaptive clinical trial set up. The book is mathematically rigorous and provides details for the development of estimation approaches under selected familial and longitudinal models. Further, while the book provides special cares for mathematics behind the correlation models, it also presents the illustrations of the statistical analysis of various real life data. This book will be of interest to the researchers including graduate students in biostatistics and econometrics, among other applied statistics research areas. Brajendra Sutradhar is a University Research Professor at Memorial University in St. John's, Canada. He is an elected member of the International Statistical Institute and a fellow of the American Statistical Association. He has published about 110 papers in statistics journals in the area of multivariate analysis, time series analysis including forecasting, sampling, survival analysis for correlated failure times, robust inferences in generalized linear mixed models with outliers, and generalized linear longitudinal mixed models with bio-statistical and econometric applications. He has served as an associate editor for six years for Canadian Journal of Statistics and for four years for the Journal of Environmental and Ecological Statistics. He has served for 3 years as a member of the advisory committee on statistical methods in Statistics Canada. Professor Sutradhar was awarded 2007 distinguished service award of Statistics Society of Canada for his many years of services to the society including his special services for society's annual meetings.

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applied longitudinal analysis: *Models for Discrete Longitudinal Data* Geert Molenberghs, Geert Verbeke, 2006-08-30 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.

applied longitudinal analysis: *Longitudinal Categorical Data Analysis* Brajendra C. Sutradhar, 2014-10-30 This is the first book in longitudinal categorical data analysis with parametric correlation models developed based on dynamic relationships among repeated categorical responses. This book is a natural generalization of the longitudinal binary data analysis to the

multinomial data setup with more than two categories. Thus, unlike the existing books on cross-sectional categorical data analysis using log linear models, this book uses multinomial probability models both in cross-sectional and longitudinal setups. A theoretical foundation is provided for the analysis of univariate multinomial responses, by developing models systematically for the cases with no covariates as well as categorical covariates, both in cross-sectional and longitudinal setups. In the longitudinal setup, both stationary and non-stationary covariates are considered. These models have also been extended to the bivariate multinomial setup along with suitable covariates. For the inferences, the book uses the generalized quasi-likelihood as well as the exact likelihood approaches. The book is technically rigorous, and, it also presents illustrations of the statistical analysis of various real life data involving univariate multinomial responses both in cross-sectional and longitudinal setups. This book is written mainly for the graduate students and researchers in statistics and social sciences, among other applied statistics research areas. However, the rest of the book, specifically the chapters from 1 to 3, may also be used for a senior undergraduate course in statistics.

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applied longitudinal analysis: *Longitudinal Data with Serial Correlation* Richard .H. Jones, 2018-05-04 This monograph is written for students at the graduate level in biostatistics, statistics or other disciplines that collect longitudinal data. It concentrates on the state space approach that provides a convenient way to compute likelihoods using the Kalman filter.

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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 contains program examples and documentation.

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