Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index More Information

Index

Numbers: **bold** = table, *italics* = figure

 2×2 tables, 116–119, **120** passim 3×3 tables, 134–135, 135, 138 adjustment for covariance method, 49-55, 130 advantage, 51 comments, 54 example, 50-54 extension of mixed model analysis (MMA), 54 age-period-cohort models, 2 Akaike's information criterion (AIC), 100, 151, 227, 230, 233-234, 238, 240 Altman, D.G., 8 Amsterdam Growth and Health Longitudinal Study, 4, 64, 85, 143 analysis of covariance, 167-170, 172, 181-186 passim analysis of variance (ANOVA), 4, 10, 12-13, 19, 29, 220 passim cross-sectional, 25 naive, 18-19 antiretroviral therapy (ART), 108 Applied Longitudinal Data Analysis book aim, xi book emphasis, xi descriptive information, 5 examples, 4 general approach, 4 main interests, 2 most important feature, xi new material in third edition, 6 prior knowledge assumption, 4 study design, 1-4 area under curve (AUC), 178, 178 calculation (Equation 10.9), 177 use as summary statistic, 177 autoregression coefficient, 88, 167, 181 autoregressive models, 88-90, 130, 181-183 data structure needed, 88 example, 88 first-order (Equation 5.5), 88 auxiliary variables definition, 210

back pain, 128, 187, 189, 190, 219 Barthel index, 153-156, 157 baseline, 164-165, 169 adjustment for, 190, 197 definition, 164 baseline hazard function, 111, 113, 115 baseline measurement, 164-165, 169-170, 172, 178, 186 baseline value, 165, 167-168, 170, 172, 176-178, 181-184, 186, 198, 216 Bayesian information criterion (BIC), 100, 151, 155, 161, 227, 229, 233–234, 238, 240 between-subjects and withinsubjects relationship, 6 disentanglement (models), 76-91 between-subjects effects, 17, 22, 24, 179, 181 between-subjects factor, 19-21, 25 between-subjects relationship, 38, 41, 67, 141 between-within models. See hybrid models binomial distribution, 122, 152, 159-160 birth cohort, 2-3 blood pressure, 143, 172, 175-178, 179-180, 182, 184-185, 187, 198-199, 201, 218 body height development with age, 3 body mass index (BMI), 201 body weight, 67, 67, 69, 71, 96 Bozdogan's criterion (CAIC), 232, 234, 238 broad data structures, 5 cardiopulmonary fitness, 96, 143 case-control studies, 1 categorical outcome variables, 5, 134-141 comparing groups, 135 example, 135-136 more than two measurements, 135 outputs, 136, 139-142

regression based methods (with example), 136-141 two measurements, 134-135 categorical variable, 20, 32-33, 59, 60-62, 65-66, 72-73, 132, 133, 161, 183, 190, 221 imputation methods, 207 causality criteria, 1, 92 causality in observational longitudinal studies, 92-115 G-methods, 107-110 joint models, 110-115 longitudinal mediation models, 94-105 outputs, 94-95, 99-110, 112-114 time-lag models, 92-94 cause and effect, 1 caution required, 19, 105, 133, 190, 212, 217, 242 CD 4 count, 108 censoring, 162 outcome measure with floor effect, 153 CHD. See coronary heart disease Chi-square, 29-30, 36-37, 46, 51, 56, 78, 118, 126, 134, 222 Chi-square test, 35, 116, 188, 202 cholesterol, 5, 5, 7-9, 15, 18, 26, 28, 49, 51-55, 57-59, 64, 70-72, 74, 76-77, 79, 81, 83-84, 94-95, 220 and body weight, 67 categorical variable, 135, 135, 137-138, 138, 140-141, 150 Friedman test, 30 linear development over time, 57 longitudinal development, 17 longitudinal regression methods, 34 CI. See confidence interval Claassen, E., 235 clustering, 143-144, 147-148, 196, 226 definition, 143 clustering score, 143 Cochran's Q, 118 disadvantage, 117

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

More Information

Index

coefficient of interest, 31, 67, 121, 169-170, 191 cohort effects, 1, 3, 3 common trend assumption, 198 comparison of changes, 169-170 comparison of changes (adjusted for baseline) basically same as 'analysis of covariance' (qv), 168 compound symmetry assumption, 11 conditional frailty model, 194 confidence interval, 7-8, 36, 46, 100, 114, 116-119, 121, 185, 189, 190 passim confounders, 68, 105, 183, 196-198 CONSORT statement, 216 contemporaneous relationship, 96-97, 101 continuous outcome variables, 4, 7-30, **61**, 122, 124, 136, 216 comments, 25 comparing groups, 19-25 components, 14 different contrasts, 26-29 floors and ceilings, 152 GEE analysis (software), 220-223 imputation methods, 207-210, 214 mixed model analysis (software), 235 modelling of time, 56-75 more than two measurements, 9-19 non-parameric equivalent of GLM for repeated measures, 29-30 outputs, 9-10, 12-16, 18-19, 21-22, 24, 27, 29 paired t-test (non-parametric equivalent), 8-9 post-hoc procedures, 25 RCT with more than one followup measurement, 172-186 RCT with one follow-up measurement, 165-172 regression-based methods, 31-55 statistical significance (sample size needed), 217 time, 13-15 transformation factors, 14 two measurements, 7-8 univariate versus multivariate approach, 19 continuous variables (imputation of missing data), 205-207 comments, 206 cross-sectional methods, 205 longitudinal methods, 206 multiple imputation, 206-207 control group, 164-166, 168-169, 186, 216

coronary heart disease, 143-144, 143, 147-148 correlated observations, 32, 44, 49, 54, 84, 89, 109, 168, 200 correlated residuals, 44, 54, 89 correlation coefficients, 43-44, 50 correlation matrix, 49, 54-55, 87, 2.2.2 correlation structures, 48, 50, 123, 124 autoregressive, 43, 45-46 exchangeable, 42, 44-46, 48, 55, 57, 121, 190, 192, **205**, 220 five-dependent, 43, 44-45 four-dependent, 122 independent, 42, 44, 46, 87, 90, 122, 124 m-dependent, 44 Poisson GEE analysis, 145, 146 stationary dependent, 42, 46 two-dependent, 43 unstructured, 43, 45-46 within-subjects, 43-44, 54 count outcome variables, 141-151 comments, 150 example, 143-147 GEE analysis, 137-146 GEE versus mixed model analysis, 147 mixed model analysis, 146-147 negative binomial regression analysis, 148-150 outputs, 144-145, 147-148, 150-151 counterfactuals, 197 counting method, 192, 195 covariance. See also adjustment for covariance method negative versus positive, 39 covariance equation, 49 covariance matrix, 19, 22 purpose, 49 covariance parameters, 51, 229, 232 covariance structures exchangeable, 50, 51, 53 five-dependent, 53 unstructured, 50, 52-54 covariate of interest, 56, 80-81, 89, 103, 108 time-dependent, 82 time-independent, 82 covariates, 1, 37, 92, 94 can be continuous, dichotomous or categorical, 142 definition, 1 time-dependent, 41, 80-81 Cox regression analysis, 110-112, 114 use, 111 Cox regression for recurrent events, 194-195, 195

problem, 191 use, 191 cross-over design, 195 cross-sectional linear regression analysis, 31-32, 49, 165 naive, 36 cross-sectional logistic regression analysis, 121 cross-sectional methods, 1, 4, 152, 164, 178 cross-sectional problems, 7, 31 cross-sectional regression analysis, 32-33, 38, 196 cubic relationship, 15 cubic S-shaped function, 58 Data Augmentation (DA), 207 data structures, 5, 6 datasets six-repeated-measurement, 7 without missing data, 49 datasets with missing data, 49, 202, 203 analysis performed on, 204-205 GEE versus mixed model analysis, 214, 214 degrees of freedom, 7-8, 10-16, 19, 29-30, 36-37, 51, 56, 58, 78 dependency of repeated observations within subjects (longitudinal problem), 7 descriptive statistics, 196 deviation score, 76-78, 80-82, 130, 132, 141 passim definition, 76, 79 diabetes, 160 dichotomous outcome variables, 1, 5, 116-133, 135-136, 147, 204, 216 comparing groups, 117, 119 GEE analysis (software), 224-226 imputation methods, 207 imputation methods (missing data), 210-212 longitudinal intervention studies, 187-194 longitudinal regression methods, 119-133 mixed model analysis (software), 235 - 242more than two measurements, 117 outputs, 118-119, 122-123, 125, 127, 131–132 regression-based methods, 189-193 simple analysis, 188 software (further reading), 235 statistical significance (sample size needed), 218

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

More Information

Index

total change over time, 117 two measurements, 116-117 dichotomous outcome variables (example), 117-119 comparing groups, 119 development over time, 117-118 two measurements, 117 dichotomous outcomes, 106, 108, 196 difference contrast, 26-27 difference in difference method, 197-200 limitation, 199 difference in proportions problem, 116 direct effect, 94, 96, 98-100, 102 Directed Acyclic Graph (DAG), 103 Disability Index of Health Assessment Questionnaire (HAQ-DI), 153, 158, 159-160 disease activity, 155, 159-160 drop-outs, 201, 202, 207, 218-219 dummy variable coding, 59, 61 dummy variables, 32-33, 60-62 65-66, 161, 183, 186, 190-191 econometrics, 79, 152, 213 educational research, 32 effect (outcome variable), 1 effect estimates, 184-185, 199, 206, 219 effect modifiers, 196 effect size, 216-217 error mean squares, 15 error sum of squares, 12-13, 19-20, 25 error variance, 36, 126, 233 eta squared, 18 excess of zeros, 150, 152, 161 factor of interest, 10 fixed effects, 41, 79 flexible parameter method, 113-114 floor or ceiling effects longitudinal two-part models (with example), 159-163 outcome variables, 152-163 outputs, 154, 156, 159-160, 162-163 tobit mixed model analysis (with example), 153-159 forced expiratory volume in one second (FEV1), 85, 88 forced vital capacity (FVC), 85,88 Friedman test, 29-30 equation, 29 Gauss-Hermite quadrature method, 235-236, 238, 240, 242

Gaussian family, 45, 47, 49, 57, 87, 90, 121 GEE. See generalised estimating equations general group effect, 20 generalised estimating equations, 42 - 46autoregressive linear analysis, 90 comparison with mixed model analysis, 48-49 comparison with mixed model analysis (count outcome variables), 147 comparison with mixed model analysis (longitudinal regression methods), 129 continuous outcome variables (software), 220-223 correlation structures, 42-44 count outcome variables, 137-146 datasets with missing data, 205, 205 dichotomous outcome variables (software), 224-226 example, 44-46 further reading, 133 linear analysis, 45, 47, 49, 55-57, 87, 121-122 logistic analysis, 122-123, 129-130, 131-132, 189-190, 192 longitudinal intervention studies, 168 longitudinal regression methods, 121-124 generalized linear model (GLM), 10 assumptions, 10 graphical representation, 180-181 limitations, 179 mixed model analysis 'extension of ', 33 non-parameric equivalent of for repeated measures, 29-30 RCT with more than one followup measurement, 178 repeated measures, 10, 12-13, 15, 18-21, 25-26, 33, 60, 178, 205, 214, 220 passim repeated measures (adjusted for baseline), 178 repeated measures (basically 'testing method'), 25 repeated measures (complex study designs), 25 repeated measures (problems), 25 repeated measures (simple longitudinal dataset), 13 univariate approach (numerical example), 12-13 genmod procedure, 220, 225 glimmix procedure, 236 GLLAMM, 159, 162

key to abbreviation, 138

G-methods, 107-110, 197 types, 108 Greenhouse-Geisser method, 15-16, 18, 21, 23-24, 179-180 group by time interaction effect, 20 growth curve analysis, 56-60 growth curve parameters, 71-72 growth trajectories subjects with different (classification), 70-75 Helmert contrast, 26, 28 high density lipoprotein cholesterol, 143 HIV patients, 108 hot-deck method, 205, 207 Hotelling's T^2 , 10 Hotelling's Trace, 16, 22 Huber-White sandwich estimator, 43.46 Hurvich and Tsai's criterion (AICC), 227-228, 230, 233-234, 238 Huynh-Feldt method, 15-16, 18, 23-24, 179-180 hybrid models (to disentangle beween- and within-subjects relationship), 6, 76-82 comments, 82 data structure needed, 77 dichotomous covariate, 85 direct estimation of, 78-80 example, 76-78 with time-dependent covariates, 80-81 hypercholesterolemia, 111-114, 117-119, 122-123, 125-127, 132, 213, 220 hypoglycaemic events, 161, 162-163 id number, 33 imputation methods, 205-213 additional analyses, 210 categorical variables, 207 comments, 212 continuous variables, 205-209, 214 cross-sectional, 215 cross-sectional versus longitudinal, 205 dichotomous variables, 207, 210-212 multiple imputation in combination with mixed model analysis, 203-209 problem, 206 independent sample t-test, 18, 20, 176-178, 196, 202-204, 204 indirect effect, 94, 96, 98-99, 101-102

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

More Information

Index

individual mean value, 76-77, 79-80, 82, 130, 141 intercepts, 33-34, 48, 126 definition, 14 intervention effect, 165, 167-170, 172, 181, 183, 186, 191, 196-198 intervention group, 165-166, 168, 195, 216, 218 short-term versus long-term effects, 176-177 intervention studies, 1, 61, 70, 92, 117, 177, 185, 216 intervention variable time-dependent versus timeindependent, 195 intraclass correlation coefficient (ICC), 36 inverse probability weighting, 109, 197 Laplace method, 239, 242 last observation carried forward (LOCF) method, 206 last value carried forward. See LVCF latent class growth analysis (LCGA), 72 latent class growth mixture modelling (LCGMM), 73 latent growth curve parameters, 74 latent normal distribution, 159 latent variable modelling framework, 74 latent variables definition, 103 learning effects, 4 lifestyle parameters, 94 likelihood ratio test, 36-37, 49-51, 54, 56, 58, 125-126, 138, 147, 159 nature and purpose, 35 linear development, 14-15, 20, 24, 26, 56-58, 61, 63, 71, 111-114, 149, 154 linear interpolation method, 206 linear regression analysis, 4, 136, 167, 199 linear relationship, 13-14, 31 linear transformation factors. 14 linear transformed dataset, 14 link function, 45, 121, 144 log likelihood, 36-37, 51, 90, 125, 140, 161 definition, 35 tobit versus linear mixed model analysis, 155 logistic mixed model analysis, 127, 190 effect of new treatment on recovery, 191

logistic regression analysis, 4, 35, 109, 119, 121, 126, 131, 191, 202 naive multinomial, 139 loneliness, 148, 151, 151 long data structure, 5, 31, 39, 198 Longitudinal Aging Study Amsterdam (LASA), 148 longitudinal and cross-sectional relationships pooled analysis, 38 longitudinal data analysis, 136 application of statistical methods, xi correct interpretation, 201, 204 mixed models, 32-34 software, 220-242 longitudinal intervention studies, 6, 164-200, 216 beyond RCT, 197-198 comments, 196, 199 dichotomous outcome variables, 187-194, 217 difference in difference method, 198-200 outputs, 169-171, 173-174, 179–180, 182–185, 187–188, 190-193, 195, 198-199 regression based methods, 168 stepped wedge designs, 196 longitudinal linear regression analysis, 119, 142 longitudinal logistic regression analysis, 142 longitudinal log-linear regression analysis, 142 longitudinal mediation models, 94 - 105comments, 103 data structure needed, 98, 106 example, 96 summary, 107 longitudinal multinomial logistic regression analysis, 142 longitudinal problem, 31 longitudinal regression analysis, 110 one of most difficult parts, 76 longitudinal regression imputation method, 206 longitudinal regression methods, 31-32 adjustment for covariance method, 130 comments, 133 dichotomous outcome variables, 119-133 example, 34-37 fixed part of model, 36 GEE, 121-124 GEE versus mixed model analysis, 127 - 129mixed model analysis, 124-127

models to disentangle betweenand within-subjects relationship, 130-132 random part of model, 36 longitudinal relationship continuous outcome and covariates (equation), 31 longitudinal studies advantage, 1 causality, 92-115 definition, 1 missing data, 201-215 popularity, 1 problems, 4 longitudinal two-part models, 159-163 biggest problem, 163 comments, 162 lower-bound method, 15-16, 18, 23-24, 179-180 lung function, 85, 88 LVCF, 206–207, 208, 208, 211, 213 Mann-Whitney U tests, 196 MAR, 201, 203, 204-205, 205, 207-209, 208, 210, 212, 213-214, 213 marginal structural models, 197 Markov Chain Monte Carlo (MCMC), 207 Markov models, 194 same as 'autoregressive models' (qv), 88 Mauchly's Test of Sphericity, 15-16, 22 maximum likelihood, 51, 209, 226-227, 229 definition, 35 maximum likelihood estimation method, 41-42 MCAR, 201, 203-204, 203, 205, 207, 208, 209, 210, 213-214, 213 McNemar test, 117-118, 134 change over time in dichotomous outcome variable, 116 disadvantage, 116 example, 118 limitation, 118 mean or median of series method, 205, 207 mean squares, 12, 15, 27 mean value, 80 mean variance adaptive Gauss-Hermite quadrature, 125 mediation analysis, 94, 96, 98-100 cross-sectional studies, 96 important statistical tool, 94 linear mixed model, 101-110 types, 96 medical ethics committees, 216 medical science, 71, 82, 152

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

More Information

Index

multivariate analysis of covariance

groups with same growth trajectory, 75 medical studies, 110, 152-153, 163, 165, 209, 213 control studies versus cohort studies, 1 designs (schematic illustration), 2 observational versus intervention, 1 melogit procedure, 235-236 memory measurement (older subjects), 4 missing at random. See MAR missing completely at random. See MCAR missing data, 149, 156, 197 alternative methods, 213 determinants, 203-204 examples, 202 GEE versus mixed model analysis, 214 generating datasets with, 202, 203 imputation methods, 205-213 informative versus noninformative, 201-202 informative versus noninformative (definitions), 201 intermittent, 201, 202 logistic regression analyses, 204 longitudinal studies, 201-215 subjects with versus subjects without, 204 missing data mechanisms, 201, 208 missing not at random. See MNAR mixed model analysis, 32-42, 56, 90, 110, 173–174, 182, 184–185, 187, 200 combination with multiple imputation (missing data), 209 comparison with GEE, 48-49 comparison with GEE analysis (longitudinal regression methods), 127-129 continuous outcome variables (software), 226-235 count outcome variables, 142, 146-147 datasets with missing data, 205, 205 development over time of continuous outcome, 34 dichotomous outcome variables (software), 235-242 extension, 54 extension of GLM for repeated measures, 33 further reading, 133 general idea, 33, 36 idea behind, 33 imputation of missing data, 207

linear, 34-35, 41, 50, 54, 59, 71-72, 77-79, 83, 86, 89, 95, 99, 103, 112, 155, 208 linear time-lag, 94 logistic, 129, 213 longitudinal data, 32-34 longitudinal intervention studies, 168 longitudinal regression methods, 124-127 more efficient than multiple imputation, 209 multinomial logistic, 137-141 prior multiple imputation 'not necessary', 210 regression coefficient (interpretation), 38-41 software (further reading), 235 standard (drawback), 107 steps, 33 ML. See maximum likelihood MNAR, 201, 203, 204-205, 208, 208, 210, 212-214, 213 model fit statistics, 90, 100 model of changes, 83-85, 87, 88, 90-91, 130-131 data structure needed, 86 models to disentangle between- and within-subjects relationship, 76-91, 130-132 estimation of within-subjects part, 82-91 hybrid, 76-82 outputs, 77-81, 84-87, 89-90 models to estimate within-subjects part of longitudinal relationship, 82-91 autoregressive (with example), 88-90 comments, 90-91 model of changes (with examples), 87-91 monotone missing data definition, 210 Mplus software, 74 multilevel analysis same as 'mixed model analysis' (qv), 32, 138multiple imputation, 207, 208, 208, 211, 213, 215 combination with mixed model analysis, 209 datasets with missing data, 206-207 illustration of, 206 'potential advantage' over mixed model analysis, 210 within-imputation versus between-imputations variance, 207 multiplication factor, 218-219

(MANCOVA), 178 multivariate analysis of variance (MANOVA), 10 multivariate tests, 15, 21 mvaghermite integration method, 125, 127, 147, 151, 154–155, 159-160, 191 naive linear regression analysis, 44 naive logistic regression analysis, 125-126 negative binomial GEE analysis, 148 negative binomial mixed model analysis, 151 negative binomial regression analysis, 143, 151 count outcome variables, 148-150 no confounding assumptions, 105 noise, 206, 209 non-collapsibility problem, 130-131, 133 normal distribution, 33, 126, 139, 150, 152, 155, 163, 210, 222 latent, 153 used in STATA, 229 null hypothesis, 11, 16, 22 number of observations, 35, 46, 90, 100-101, 125 number of subjects, 35, 46, 67 object-oriented software, 222 observational cohort studies types, 1 observational longitudinal studies, 1-4, 70, 164 causality, 6, 92-115 observational studies, 197-198 odds ratio, 121, 126, 138, 189, 190-191, 193-194 pools two interpretations, 121 one-within design, 19, 21, 25, 29 definition, 10 one-within, one-between design, 19-21, 25 OR. See odds ratio outcome variable of interest, 34, 128, 155, 187, 202 standard deviation, 217 outcome variables, 1, 92, 94, 108, 121, 128, 197, 204 characteristics, 4 floor or ceiling effects, 6, 152-163 overall error variance divided into two parts, 36 overall regression coefficient definition, 77 overdispersion, 143, 148-149 pair of regression analyses, 95 paired t-test, 7-10, 18-19, 31

assumptions, 7

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

More Information

Index

paired t-test (cont.) cholesterol (difference t=1 and t=6), 9 limitation, 7 non-parametric equivalent, 8-9 normality assumption, 7 not possible (situation with more than two repeated measurements), 10 parametric survival analysis, 113 path analyses, 104 pattern mixture models, 213 period effects, 2-3 physical activity, 3, 143-148, 168, 168, 170-171, 173-174, 176 longitudinal development with age, 3 physical fitness, 94, 100-102, 104, 106-114 Pillai's Trace, 16, 22 placebo, 164, 172, 175-176, 177-178, 180 Poisson distribution, 143-144, 148, 152, 159, 161 characteristics, 141, 143 skewness to right characteristic, 150 Poisson family, 144-145 Poisson GEE analysis, 144-145, 146, 148 Poisson mixed model analysis, 146-147, 149, 151, 161 Poisson regression analysis, 142-143, 147-148, 151-152 polynomial contrast, 26 polynomial function second order, 56 third degree, 58 population average method, 128, 129 post-hoc procedures, 25-26 potential outcome analysis, 104, 197-198 propensity score adjustment, 197 Proper, K.I., 168 proportion of change, 116-119, 134-136 standard error, 118 prospective cohort studies design, 1 pseudo-likelihood method, 242 p-values, 7-9, 13, 15, 25-26, 29, 36-37, 46, 58, 61, 100, 121, 138, 149, 155, 161, 178, 189, 191, 206, 222, 229 quadratic development, 20, 23-24,

26, 56, 59–62, 64 quadratic function, 18, 58 quadratic relationship, 13, 15 quadratic term, 56, 58 quadrature points, 236, 242 quasi-causal relationships, 92, 106 quasi-likelihood, 42

R software, 6, 220 GEE analysis with continuous outcome variable, 221-222, 224 GEE analysis with dichotomous outcome variable, 224, 227 linear mixed model analysis with only random intercept, 235 linear mixed model analysis with random intercept and random slope, 235 logistic mixed model analysis with random intercept, 242 mixed model analysis with continuous outcome variable, 229-231 mixed model analysis with dichotomous outcome variable, 239 - 240random allocation at baseline, 164-165 random coefficient analysis, 33, 36 random effects, 80 variances and covariances, 139 random intercept, 35-37, 39, 41, 48, 54, 58-60, 62-64, 66, 71, 78-79, 112, 125-127, 139-140, 147, 154, 156, 159, 162, 214, 228, 232-233, 235, 237-238, 240-241 software syntax, 226 random intercept variance, 36, 42, 51, 80, 84, 89, 126, 128, 155-156, 233, 240 random slope, 36-37, 39, 49, 56, 58-60, 71, 78, 112, 125, 127, 140, 160, 214, 232, 235 definition, 33 for deviation score, 80 software syntax, 226 random slope variance, 42, 126, 233 random variances, 79 randomized control trial with more than one follow-up measurement continuous outcome variables, 172-186 GLM for repeated measures, 178 GLM for repeated measures (adjusted for baseline), 178 regression-based methods,

regression-based methods, 178–186 simple analysis, 175–177 summary statistics, 177–178 randomized control trial with one follow-up measurement

continuous outcome variables, 165–172 randomized control trials, 1-2, 128, 164 stepped wedge designs, 196 rank numbers mean rank, 9 RCT. See randomized control trials real life, 9, 45, 54, 105, 110, 161, 165, 172, 197, 203, 213 reference category, 60, 138, 185 regression based methods, 59, 204 advantage, 178 comparing groups, 61 regression coefficient, 31-33, 36, 46, 50-51, 56, 58, 60, 67, 69-70, 76, 80-84, 88, 92-93, 121, 163, 191, 208 calculation, 36 interpretation, 67 interpretation (mixed model analysis), 38-41 one for each covariate preferable, 153 pooled longitudinal, 86 random variation, 48 range (after multiple imputation), 211 standardized, 88 varying between subjects, 48 regression model fixed versus random parts, 79 regression to mean, 6, 165-168, 166, 172, 177, 182, 184, 186, 196-197 regression-based methods, 196 adjustment for covariance, 49-55 cateogrical outcome variables (with example), 136-141 comments, 41-42 continuous outcome variables, 31-55 dichotomous outcome variables, 189-193 GEE, 42-46 longitudinal, 31-32 mixed model analysis (mixed model analysis), 32-42 mixed model analysis versus GEE, 48 - 49outputs, 35, 37, 41, 44-47, 49, 51-53 RCT with more than one followup measurement, 178-186 relative change, 166, 167 relative risk, 189, 192 definition, 188 repeated contrast, 26, 28-29 repeated measures method, 186-187 non-parameric equivalent of GLM, 29-30 research grants, 216

research question, 69, 75, 90, 152, 154, 177, 185

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

Index

as basis for analysis, 4 residual change general idea, 167 residual pseudo-likelihood method, 236, 240 residual variance, 36, 79-80, 155-156, 227, 232 restricted maximum likelihood, 35, 41-42, 50, 229 default estimation method (software packages), 226 Roy's Largest Root, 16, 22 sample size, 7, 9, 11, 19, 164 sample size calculations, 216-219 example, 218 information needed, 218-219 SAS, 6, 220 GEE analysis with continuous outcome variable, 220-221, 224 GEE analysis with dichotomous outcome variable, 224, 227 linear mixed model analysis with only random intercept, 235 linear mixed model analysis with random intercept and random slope, 235 logistic mixed model analysis with random intercept, 242 mixed procedure, 227-229 mixed model analysis with continuous outcome variable, 227-229 mixed model analysis with dichotomous outcome variable, 236 - 237scale parameter purpose, 45 SD. See standard deviation selection models general idea, 213 semi-parametric survival analysis, 111 serum cholesterol, 4, 143, 168-169, 168, 171, 173-174, 176 sex, 5, 5, 21-22, 24, 61-63, 82, 120, 138, 150-151, 154-156, 203, 204 signed rank sum test, 8-9 significance level, 8, 21, 56, 63, 118, 216-218 simple contrast, 26-27, 29 single imputation methods, 206 smoking, 85, 87, 88, 152, 163 social sciences, 32, 71 software, 5, 8-9, 35 software for longitudinal data analysis, 220-242 GEE with continuous outcome variable, 220-223 GEE with dichotomous outcome variables, 224-226

mixed model analysis with continuous outcome variables, 226-235 mixed model analysis with dichotomous outcome variables, 235-242 outputs, 221-223, 225-228, 230-234, 237-241 software packages, 6, 8-9, 11, 26, 34, 42, 121, 126, 137, 178 sphericity assumption, 11, 15–16, 18-19, 21, 23, 179-180 definition, 19 violation, 19 sphericity coefficient (epsilon), 11, 15 SPIRIT study, 160 SPSS, 6, 178, 220 GEE analysis with continuous outcome variable, 222-223, 224 GEE analysis with dichotomous outcome variable, 223-224, 227 linear mixed model analysis with only random intercept, 235 linear mixed model analysis with random intercept and random slope, 235 logistic mixed model analysis with random intercept, 242 mixed model analysis with continuous outcome variable, 231-235 mixed model analysis with dichotomous outcome variable, 240-242 squared differences, 11 standard deviation, 8, 46, 49, 115 artificial decrease, 206 residual (or error), 229 standard errors, 36, 38, 56, 67, 80, 90, 124, 161, 199 difference in proportions (calculation), 116 distribution (after multiple imputation), 212 estimation (model-based procedure), 220 GEE versus mixed model analysis (mixed model analysis), 49 model-based method, 224 robust, 46, 49, 85, 220, 222, 224 standard longitudinal regression, 82, 85 standard model, 88, 90-93, 93, 94, 96 STATA, 5, 35, 79, 138, 159, 220, 235 default estimation method (ML), 226 GEE analysis with continuous outcome variable, 220, 224 GEE analysis with dichotomous outcome variable, 224, 227

linear mixed model analysis with only random intercept, 235 linear mixed model analysis with random intercept and random slope, 235 logistic mixed model analysis with random intercept, 242 mixed model analysis with continuous outcome variable, 2.2.6 mixed model analysis with dichotomous outcome variable, 235 - 236use of z-distribution, 229 stepped wedge designs, 195-196 definition, 195 schematic illustration, 196 usually longitudinal, 196 structural equation model, 74, 104 general idea, 71 typical illustration, 74 Stuart-Maxwell test, 134-135 study design, 216 subject specific method, 128, 129 subject variance, 128 sum of skinfolds, 5, 35-37, 40-41, 45–47, **48**, 49, 51–55, 64, 70, 72–73, 76–77, 79–81, 83–84, 87, 90, 94-95, 121, 131, 139, 220 passim longitudinal regression methods, 34 sum of squares, 11-15, 18, 21, 27, 33 summary statistics examples (intervention studies), 177 general idea, 177 survival analysis, 108, 110-111, 114-115, 196 svntax R, 222, 224, 229, 231, 239 SAS, 220, 224, 229, 236 SPSS, 223–224, 232, 235, 240, 242 STATA, 220, 226, 235-236 t-distribution R, 229 SAS, 229 temporality, 1, 92 tertiles, 81 test effects, 4 test statistic, 7-8, 10, 67 time, 2, 9-10, 26, 149, 151, 154-156, 169-170, 178 relationship (shape) between outcome variable and, 13-15 time at risk, 194-195, 195 definition, 192 time effect, 13, 15, 18, 20-21, 25, 178 time modelling, 56-75 adjustment for time, 64-69

Cambridge University Press & Assessment 978-1-009-28804-0 — Applied Longitudinal Data Analysis for Medical Science 3rd Edition Index

More Information

Index

time modelling (cont.) adjustment for time (longitudinal data analysis), 70 comparing groups, 60-63 growth curve analysis, 56-60 interaction with time, 69-70 outputs, 57-60, 62-66, 68-69, 71-74 subjects with different growth trajectories (classification), 70 - 75time versus age, 68 time of measurement effect, 3 time to event method, 192 time variable, 56, 58, 61, 64, 67-68, 82, 183, 196, 199 time-lag models, 93, 96, 99, 150 causality in observational longitudinal studies, 92-94 data structure needed, 92 occasion when useful, 93 time-lag relationship, 95-98, 101 time-varying confounders, 107, 109 tobit mixed model analysis, 152-159 general idea, 153

Toeplitz 5 covariance structure, 53 total change over time, 116–118, 134–135 total time method, 192 treatment effect, 178–179, 182, 184, 192 two-part regression models, 152 univariate approach, 11, 21 longitudinal dataset (four

measurements, six subjects), 12 numerical example, 12–13 validity, 11 upper or lower censoring same as 'floor or ceiling effects' (qv), 152

variance parameters, 50–51, 229 vector of covariate over time, 38 vector of outcome over time, 38

Wald test, 125, 146, 148, 150, 222 Wang, N., 209

Weibull baseline hazard function, 113

Weibull distribution, 113 Wilcoxon signed rank sum test, 8, 10 Wilks' Lambda, 16, 22 within-subjects and betweensubjects relationship disentanglement (models), 76-91 within-subjects correlation, 43-44, 54-55 within-subjects effects, 16, 18, 23-24, 179-180 within-subjects error sums of squares, 20 within-subjects factor, 19, 21, 25 within-subjects interpretation, 126 within-subjects relationship, 26, 38, 41, 67, 126, 141 within-time sum of squares, 13 xtreg procedure, 79-81

zero-inflated Poisson regression, 152 z-statistic, 36, 222 calculation, 36, 46 z-value, 9, 61, 67, 121, 138, 149, 161

© in this web service Cambridge University Press & Assessment