

INDEX

- Aalen model, additive, 317–320
- Accelerated failure time:
 - exponential regression model, 252, 259
 - log-logistic regression model, 273–282
 - parametric regression models, 244, 245
 - Weibull regression model, 260–261
- Acceleration factor, 247
- ACTG 320 study. *See* AIDS Clinical Trials Group (ACTG 320) study
- Additive models, 314–328
- Additive relative hazard model, 70–71, 314–315
- Adequacy. *See* Assessment of adequacy
- Adjusted survival function, 121–130
- Aging, conditional failure rate, 63
- AIDS Clinical Trials Group (ACTG 320) study:
 - example data sets, 12, 14
 - fitted proportional hazards regression model, 98–99, 107–108
 - nested case-control studies, 310–314
 - proportional hazards model extensions, 210–213
 - proportional hazards regression model, 69, 77, 82
- Akaike Information Criterion (AIC), 282
- Analysis of covariance, 108. *See also* Multiple covariates
- Analysis time, time-varying (t -dependent) covariates, 213
- Approximate confidence intervals:
 - Kaplan-Meier estimator, 37–40
 - survival function estimation, 43
- ART program, 343–345
- Assessment of adequacy, 169–206
 - covariates selection, 135
 - frailty models, 302–303
 - goodness-of-fit, 191–195
 - influential and poorly fit subjects identification, 184–191
 - overview, 169–170
 - proportional hazards assumption, 177–184
 - residuals, 170–177
- Backward elimination, stepwise selection, 156
- Baseline hazard function:
 - fitted proportional hazards regression model, 93
 - proportional hazards assumption, 177–178
 - proportional hazards model, 89–90
 - proportional hazards model extensions, 207

- Baseline hazard function (*continued*)
 - semiparametric regression models, 69–70
 - Weibull regression model, 270–271
- Baseline survival function, fitted
 - proportional hazards regression model, 121–122
- Best subsets selection. *See also* Covariates selection
 - covariates selection, 132, 159–162
- Binary covariates. *See* Dichotomous (binary) covariates
- BMDP statistical package, best subsets selection, 160
- Body mass index, 1–2
- Breslow approximation, tied survival times, 85–87
- Breslow estimator, cumulative baseline hazard function, 175
- Breslow test, 47
- Bronchopulmonary dysplasia (BPD), low birth weight infants, 56–58
- Brookmeyer-Crowley confidence interval, 40, 57, 142
- Cancer, recurrent event models, 287–296
- Cancer clinical trials:
 - example data sets, 11–12
- Censored observations. *See also* specific censored observations
 - fitted proportional hazards regression model, 93–94
 - proportional hazards model extensions, 228–240
- Censoring mechanisms. *See also* specific censoring mechanisms
 - interval censored data, 9, 228–240
 - left censored data, 8–9, 228–240
 - regression modeling, 3–9
 - right censored observations, 6–7
 - survival function comparisons, 44–45
- Center for Outcomes Research (COR), 220–221
- Change in coefficient modeling, covariates selection, 133–134
- Collinearity, 167
- Comparing survival functions, 44–59
- Competing risk models, 329–339
- Conditional failure rate, cumulative hazard function, 62–63
- Conditional logistic regression model, 75
- Conditional models, recurrent event models, 289–290
- Conditional probability, 233–234
- Confidence bands, simultaneous, survival function estimation, 32–34
- Confidence interval:
 - exponential regression model, 251
 - fitted proportional hazards regression model, 95–97, 101, 112, 127–130
 - purposeful selection, 141–153
 - survival function estimation, 27–28, 34–37, 39–44
- Confounding. *See* Control of confounding
- Constant slopes, stratified proportional hazards model, 209
- Continuous scale selection, 106–108, 136–141. *See also* Covariates selection
- Control of confounding, 108–120
- Convergence, *see* numerical problems
- Cook's distance:
 - influential and poorly fit subjects identification, 185, 187–188, 189
 - exponential regression model, 255–256
 - Weibull regression model, 265–266, 268
- Coronary Vascular Disease (CVD) Risk Study, 333–339
- Counting processes, 359–363
 - assessment of adequacy:
 - overall goodness-of-fit, 193
 - residuals, 173, 175
 - cumulative (integrated) intensity process, 61
 - recurrent event models, 288
 - survival function estimation, 29–31
- Covariance matrix:
 - assessment of adequacy:
 - goodness-of-fit, 191
 - residuals, 172
 - best subsets selection, 160
 - fitted proportional hazards regression model, 103–104
 - proportional hazards regression model, 81–82
- Covariate(s):

- right censored observations, proportional hazards regression model, 72–73, 80–81
- survival function comparisons, 44
- Covariate-adjusted survival function, 121–130
- Covariates selection, 133–153. *See also* specific covariates
 - best subsets selection, 159–162
 - continuous covariates, 136–141
 - example of, 141–153
 - iterative selection, 132
 - methods of, 132
 - multivariable fractional polynomials, 132, 162–166
 - purposeful selection, 133–136, 141–153
 - stepwise selection, 154–159
- Cox proportional hazard model, 70–72
- Cox-Snell residuals:
 - assessment of adequacy, 175
 - parametric regression models:
 - exponential regression model, 257
 - log-logistic regression model, 281
 - Weibull regression model, 268–269
- Cumulative baseline hazard function, residuals, 174, 175
- Cumulative hazard function, 61–62
- Cumulative incidence function (CIF), competing risk models, 330
- Cumulative (integrated) intensity process, 61
- Data:
 - AIDS Clinical Trials Group (ACTG) 32 Study, 12, 14, 69, 77, 82, 98–99, 107–108, 210–213, 310–314
 - German Breast Cancer Study Group, 11, 13, 112–113, 118–120, 121–130, 234–237
 - Global Registry of Acute Coronary Events (GRACE), 220–227
 - Psoriasis Study, 292–294
 - UMARU IMPACT Study (UIS), 10–12, 113–114, 216
 - Worcester Heart Attack Study (WHAS), 2–11, 16, 17, 20, 22, 24, 27, 31, 33, 36, 38–39, 41, 43, 44, 49–51, 55–57, 61–64, 67, 73, 86–87, 95, 96, 98, 101–102, 104, 106, 115–117, 136, 141–153, 157, 161–165, 180, 190–192, 195–198, 207, 209–210, 228–229, 231, 250, 252–253, 255, 258, 264, 268, 277, 282, 299, 303, 346, 348, 350
- Delayed entry, 7, 228–240
- Delta method, 28–29, 355–358
- Density function, 24, 37–39, 63, 73, 74, 247
- Descriptive methods, 16–66
 - Nelson-Aalen estimator, 59–61
 - overview, 16
- Deviation from means coding, 104–105
- Dichotomous (binary) covariates:
 - fitted proportional hazards regression model, 94–99, 196–200
 - proportional hazards assumption, 177–178, 183
- Discriminant analysis, 133–134
- Disease process:
 - competing risk models, 329–339
 - survival time modeling, 286
- Educational interventions, IV drug use, 8–9
- Effect modifiers, 108
- Efron approximation, tied survival times, 86, 87
- EGRET software package, 315
- EM algorithm, frailty models, 298
- Epidemiology, covariates selection, purposeful selection, 133–134
- Error component, residuals, 174
- Estimation:
 - covariate-adjusted survival function, 121–130
 - hazard ratios, recurrent event models, 294
 - survival function, 17–27
 - time ratio, 246
- Estimation-Maximization (EM) algorithm, frailty models, 298
- Example data sets, 9–13
- Exponential regression model, 246–260. *See also* Parametric regression models
- External time-varying (G -dependent) covariates, 214. *See also* Time-varying covariates
- Extreme collinearity, 167

- Final model, covariates selection, 135, 195–205
- Fitted proportional hazards regression model, 92–131. *See also* Assessment of adequacy
- continuous scale covariate, 106–108
 - estimated covariate-adjusted survival function use, 121–130
 - multiple-covariate models, 108–120
 - nominal scale covariate, 94–105
 - overview, 92–94
 - validity, 169
- Fractional polynomials (covariates selection)
- continuous covariates, 136–139
 - purposeful selection, 145–146, 148
- Frailty models, 286, 296–308
- shared, 298, 299, 303, 304
- Gamma distribution, 297, 298, 300, 302, 306
- Gehan test, 45, 47
- Gender differences:
- additive models, 315
 - fitted proportional hazards regression model, 115–118, 197–205
 - parametric regression models:
 - exponential regression model, 250–251, 255–256, 259–260
 - log-logistic regression model, 280
 - Weibull regression model, 267, 272
 - survival function comparisons, 44–45, 50–52
- German Breast Cancer Study Group, 11, 13, 112–113, 118–120, 121–130, 234–237
- Global Registry of Acute Coronary Events (GRACE), 220–227
- Goodness-of-fit:
- assessment of adequacy, 191–195
 - competing risks models, 337
 - exponential regression model, 253, 259
 - recurrent event models, 292
- Greenwood estimator, 29, 34, 37
- Grønnesby-Borgan test:
- competing risks models, 337
 - exponential regression model, 257–258
 - log-logistic regression model, 277, 281
 - recurrent event models, 292
- GIF smoothed added variable plot:
- continuous covariates, 140–141
 - purposeful selection, 147–150
- Hall/Wellner confidence band, 33, 34, 364
- Harrington-Fleming tests, 49
- Hazard function. *See also* Fitted
- proportional hazards regression model; Proportional hazards model; Survival function
 - definition of, 63
 - exponential regression model, 247
 - fitted proportional hazards regression model, 92–93, 102–103
 - frailty models, 296, 299–300
 - kernel smoothing, 63–64
 - proportional hazards model, 87–90
 - proportional hazards model extensions, 207–208, 215–216
 - recurrent event models, 288
 - regression models, 67–69
 - semiparametric regression models, 69–71
 - univariable, covariates selection, 136–137
 - Weibull regression model, 260–261
- Hazard rate, exponential regression model, 259
- Hazard ratio(s):
- exponential regression model, 247, 251
 - fitted proportional hazards regression model, 93, 101–102, 106–107, 196–197
 - proportional hazards assumption, 177
 - recurrent event models, 294
 - stratified proportional hazards model, 209–210
 - time-varying (-dependent) covariates, 217–219, 226
- Heterogeneity, frailty models, 296–297
- Hormone therapy. *See* German Breast Cancer Study Group: UTMARU IMPACT study (UTS)
- Hosmer-Lemeshow test, 192
- Infancy, survival function comparisons, 56–58
- Influential subject identification, 184–191
- Information matrix, 81–83
- Information sandwich estimator, 291

- Integrated (cumulative) intensity process, 61
- Interactions, covariates selection, 134–135
- Intercepts, fitted proportional hazards regression model, 99
- Internal time-varying (-dependent) covariates, 214. *See also* time-varying (-dependent) covariates
- Interpretation, of results, 195–203. *See also* Fitted proportional hazards regression model
- Intensity process, 61
- Interval censored data, 9, 228–240
- Iterative selection, covariates selection, 132
- IV drug use, educational interventions, 8–9
- Kaplan-Meier estimator:
 - assessment of adequacy
 - exponential regression models, 257, 258
 - log-logistic regression model, 280, 282
 - proportional hazards regression model, 124
 - Weibull regression model, 268, 269
 - competing risk models, 330–331
 - covariates selection, 133
 - definition, 22
 - proportional hazards assumption, 181–182
 - survival function comparisons, 44, 48–49, 50–52, 58
 - survival function estimation, 17–27, 87–90
- Karnofsky performance scale, 14, 210–213
- Kernel smoothing, hazard function, 63–64
- Least-squares score test, proportional hazards assumption, 179
- Left censored data, 7–9, 228–240
- Left truncated observations, 6, 230
- Length biased sampling, 8
- Leverage, influential and poorly fit subjects identification, 184
- Life-table estimator, 25–26
- Likelihood displacement statistic, 188–189
 - log-logistic regression model, 279
- Likelihood function. *See also* Maximum likelihood estimation; Maximum partial likelihood function; Partial likelihood function; Partial likelihood ratio test
- proportional hazards regression model, 73–74, 87–90
- time-varying (-dependent) covariates, 235–236
- Likelihood ratio test, fitted proportional hazards regression model, 98
- Linear predictor, 177, 179
- Linear regression, 1–2, 79, 84, 117, 123
 - assessment of adequacy, 169, 185
 - covariates selection, 133–134, 136
- Link function, 92, 235
- Log hazard:
 - continuous scale covariates, 136–141
 - fitted proportional hazards regression model, 93, 105, 107, 109–110, 116, 117
 - time-varying (-dependent) covariates, 217–219
- Logistic regression, 1–2, 93–95
 - assessment of adequacy:
 - influential and poorly fit subjects identification, 185
 - overall goodness-of-fit, 192, 193
 - best subsets selection, 159–160
 - marched, stratified proportional hazards model, 208–209
- Log-likelihood function:
 - Log-logistic regression model, 273–282
 - Weibull regression model, 262–263
- Log-logistic regression model, 273–282
- Log-log survival function, 30–32
- Log partial likelihood:
 - exponential regression model, 252
 - proportional hazards regression model, 78
 - residuals, 171
- Log-rank test, 47–48, 51, 57, 58
- Log transformation, 93
- Low birth weight infants, survival function comparisons, 56–58
- Main effects model:
 - assessment of adequacy, 169
 - covariates selection, 134–135
 - purposeful selection, 147–148
- Mallow's C , best subsets selection, 160–161

- Mantel-Haenszel test, survival function comparisons, 47, 49
- Marginal model, 290, 295, 296
- Markov Chain Monte Carlo (MCMC), 347, 348
- Martingales. *See also* Residuals
 - assessment of adequacy:
 - overall goodness-of-fit, 191
 - influential and poorly fit subjects identification, 189
 - residuals, 174–177
 - log-logistic regression model, 277
 - survival function estimation, 29–31
- Matched logistic regression analysis, 208–209
- Matrix algebra, 53
- Maximum likelihood estimation. *See also* Likelihood function
 - covariates selection, 136–137
 - exponential regression model, 248–249
 - log-logistic regression model, 274–275
 - Weibull regression model, 263
- Maximum partial likelihood function. *See also* Likelihood function
 - proportional hazards regression model, 75–76, 84, 88–90
 - stratified proportional hazards model, 210
- Mean survival time, 123
- Median survival time:
 - Kaplan-Meier estimator, 51
 - survival function comparisons, 54
- Mfp procedure, covariates selection, multivariable fractional polynomials, 162–166
- Missing:
 - at random (MAR), 347
 - completely at random (MCAR), 346–347
 - data, 346–351
- Model assessment. *See* Assessment of adequacy
- Model development, 132–168
 - covariates selection, 133–153
 - best subsets selection, 159–162
 - continuous covariates, 136–141
 - example of, 141–153
 - multivariable fractional polynomials, 162–166
 - stepwise selection, 154–159
 - numerical problems, 166–167
 - overview, 132–133
- Model proportional hazards model
 - extensions. *See* Proportional hazards model extensions
- Modified Cox-Snell residuals, 175. *See also* Cox-Snell residuals
- Monotone likelihood, numerical problems, 166–167
- Monotone ordering, survival function comparisons, 59
- Mortality rate, survival function estimation, 27
- Multiple covariates:
 - fitted proportional hazards regression model, 108–120
 - proportional hazards regression model, 80–81
 - purposeful selection, 132, 133–136
- Multiple events, 287–296
- Multiple imputation, 346–351
- Multivariable fractional polynomials. *See also* Covariates selection, 132, 136–137, 162–166
- Nelson-Aalen estimator, 59–61, 63, 139–140, 228, 257
- Nested case-control studies, 286, 308–314
- Nested model, 84, 85
- Nominal scale covariate, fitted proportional hazards regression model, 94–105
- Not Missing At Random (NMAR), 347
- Null hypothesis:
 - adequate fit exponential regression model, 259
 - linear covariate in log hazard, 138
 - no time varying effect, 181
 - proportional hazards regression model, 78, 82
 - statistical tests, 47, 54
- Observed information, proportional hazards regression model, 76–77
- Observed information matrix, 81
- Odds-ratio estimator, 94, 95, 169
- Odds-ratio interpretation, log-logistic regression model, parametric regression models, 273–274

- Oxygen therapy, low birth weight infants, survival function comparisons, 56–58
- Parameter estimation:
 log-logistic regression model, 277–278
 regression models, 67–68
 Weibull regression model, 262–263
- Parametric regression models, 244–285. *See also* Exponential regression model, log-logistic regression model, Weibull regression model
 exponential regression model, 246–260
 forms of, 283
 log-logistic regression model, 273–282
 overview, 244–246
 parameter estimation, 232
 semiparametric regression models, 69–72
 Weibull regression model, 260–273
- Partial likelihood function. *See also* Likelihood function
 exponential regression model, 252
 frailty models, 302–303
 proportional hazards regression model, 73–76
 recurrent event models, 290–291
 residuals, 171
 stratified proportional hazards model, 209–210
 tied survival times, 85–87
- Partial likelihood ratio test. *See also* Likelihood function
 covariates selection, 154–156
 fitted proportional hazards regression model, 98
- Percentiles, 36–40, 204, 205, 247, 251, 262, 274
- Peto-Prentice test, survival function comparisons, 48–49, 50, 51, 57, 58
- Poorly fit subject identification, 184–191
- Power, 340–346
- Predictable counting process technology, 48
- Preliminary main effects model, 134
- Presentation of results, 195–205
 time-varying (–dependent) covariates, 239–240
- Product limit estimator, 17
- Proportional hazards model. *See also* Assessment of adequacy; Fitted
 proportional hazards regression model, Hazard function; Model development; Regression models
 additive models, 327
 assessment of adequacy, 177–184
 covariates selection:
 best subsets selection, 159–160, 160–162
 purposeful selection, 133–136, 141–153
 stepwise selection, 155–156
 exponential regression model, 253, 254
 fitting, 72–85, 93
 fitting with tied survival times, 85–87
 frailty model, 305
 nested case-control studies, 308–314
 recurrent events, 287–288
 survival function estimation, 87–90
- Proportional hazards model extensions, 207–243. *See also* Assessment of adequacy; Hazard function
 overview, 207–208
 stratified proportional hazards model, 208–213
 time-varying (–dependent) covariates, 207–208, 213–227
 truncated, left censored, and interval censored data, 228–240
- Proportional odds, 274
- Psoriasis study, 292
- Purposeful selection. *See also* Covariates selection
 covariates selection, 132, 133–136
 example of, 141–153
- P*-value:
 covariates selection, 134, 135–136
 multivariable fractional polynomials, 164
 overall goodness-of-fit, 193
 purposeful selection, 151–153
 stepwise selection, 158–159
- PWP-CP and PWP-GT models, recurrent event models, 289–290, 294, 295–296
- Quantiles, 28, 35–40, 44, 124, 133, 212, 239
- Random effects, 286, 299, 304
- Recurrent event models, 287–296

- Reference cell coding, 99–100, 104–105
- Regression models, 1–15, 67–91. *See also*
 Assessment of adequacy; Fitted
 proportional hazards regression
 model; Model development; specific
 regression models
- censoring mechanisms, 3–9
- example data sets, 9–13
- overview, 1–3, 67–69
- proportional hazards regression model:
 fitting, 72–85
 fitting with tied survival times, 85–87
 survival function estimation, 87–90
- selection of, 1
- semiparametric models, 69–72
- Residuals. *See also* Martingales
 assessment of adequacy, 170–177
 influential and poorly fit subjects
 identification, 184–195, 187
- Cox-Snell, 175, 257, 268–269, 281
- Martingale, 174–177
- modified Cox-Snell, 175
- proportional hazards assumption, 178,
 180–183
- scaled score, 187, 279
- Schoenfeld, 171–173, 178, 180–183
- score, 184–195
- Results, interpretation and presentation,
 195–205
- Right censored observations:
 proportional hazards model, 72–73
 proportional hazards model extensions,
 207–208
- regression modeling, 6–8
- Weibull regression model, 262–263
- Right truncated observations, 230
- Risk score procedure:
 fitted proportional hazards regression
 model, 127–130
- time-varying (t -dependent) covariates,
 239
- Row total times column total divided by
 grand total estimator, 46–47
- Sample size and power, 340–346
- SAS statistical package:
 confidence intervals, 32
- covariates selection:
 best subsets selection, 160–161
- multivariable fractional polynomials,
 162
- exponential regression model, 248, 254
- frailty models, 298
- influential and poorly fit subjects
 identification, 187
- missing data, 346–351
- proportional hazards regression model,
 79
- recurrent event models, 288, 291
- survival data, 37
- survival function comparisons, 47, 54
- survival function estimation, 43–44
- tied survival times, 85
- Weibull regression model, 261, 265
- Scale parameter, Weibull regression model,
 261
- Scaled score residuals:
 influential and poorly fit subjects
 identification, 187
- log-logistic regression model, 279
- Scatterplots, assessment of adequacy, 169.
See also Assessment of adequacy
- Schoenfeld residuals:
 assessment of adequacy, 171–173
- proportional hazards assumption, 178,
 180–183
- Score residuals, influential and poorly fit
 subjects identification, 184–195
- Score test, covariates selection, 154
- Semiparametric proportional hazards
 model, 99
- Semiparametric regression models, 69–72
 additive models, 316
- parametric regression models, 245–246
- Shape parameter, Weibull regression model,
 261
- Shared frailty models, 298
- Simultaneous confidence bands, survival
 function estimation, 32–34
- Smoothed added variable plot:
 continuous covariates, 140–141
- purposeful selection, 147–159
- Smoothing, kernel, 63–64
- Splines, 141, 227
- S-PLUS statistical package:
 exponential regression model, 254
- frailty models, 298
- recurrent event models, 288, 291

- SPSS statistical package:
 proportional hazards regression model,
 79
 survival function estimation, 43-44
- STATA statistical package:
 additive models, 319, 320-321
 assessment of adequacy:
 influential and poorly fit subjects
 identification, 187
 proportional hazards assumption, 180
 covariates selection, 139
 multivariable fractional polynomials,
 162, 164-165
 purposeful selection, 145-146,
 148-150
 exponential regression model, 248, 254
 frailty models, 298, 299, 303
 log-logistic regression model, 275
 missing data, 346-351
 nested case-control studies, 310
 recurrent event models, 288, 291
 survival data, 37, 63
 survival function comparisons, 49, 54,
 61
 survival function estimation, 43-44
 tied survival times, 85, 87
 time-varying (-dependent) covariates,
 236
 Weibull regression model, 261, 263,
 264
- Statistical significance:
 covariates selection, 133-134, 135-136
 survival function comparisons, 45-59
- Statistical tests. *See also* Covariates
 selection; specific statistical tests
 calculation of, 45-46
 fitted proportional hazards regression
 model, 103-104
 frailty models, 302-303
 linear covariates in log hazard, 138
 proportional hazards regression model,
 78-80, 83
- Stepwise selection, 132, 154-159. *See also*
 Covariates selection
- Stratified proportional hazards model,
 207-213
 recurrent event models, 290-291
- Subdistribution function, competing risk
 models, 330
- Survival data. *See also* Regression
 modeling
 disease process, 286
 regression models, 1-15
 residuals, 170
- Survival function. *See also* Hazard function
 compared, descriptive methods, 44-59
 estimated covariate-adjusted survival
 function, 121-130
 estimation of, 17-27
 proportional hazards regression model,
 87-90
 use of estimated survival function,
 27-44
- Larone-Ware test, survival function
 comparisons, 50, 51, 57, 58
- Taylor series expansion, Nelson-Aalen
 estimator, 60
- Tied survival times, proportional hazards
 regression model fitting, 85-87
- Time-dependent covariates, 207, 208,
 213-227
- Time ratio:
 exponential regression model, 246-247,
 251
 Weibull regression model, 270
- Time-to-event regression model,
 assessment of adequacy, residuals,
 173
- Time-varying (-dependent) covariates,
 207-208, 213-227
- Total Time-Restricted (TT-R) models,
 recurrent event models, 291
- Treatment variable, covariates selection,
 135
- Truncated data, 6-7, 228-240
- Type I error, 139, 179, 340
- U. MARC IMPACT study (UIS), 10-12,
 113-114, 216
- Unconditional failure rate, cumulative
 hazard function, 62-63
- Uniformly distributed, 20, 25, 167, 342
- Univariable hazard function, covariates
 selection, 136-137
- Validity. *See* Assessment of adequacy;
 Statistical tests; specific tests

- Wald test:
- covariates selection, 134, 135
 - multivariable fractional polynomials, 163, 164
 - purposeful selection, 142–144
 - stepwise selection, 154
- exponential regression model, 250, 259–260
- fitted proportional hazards regression model, 95, 97, 98, 104, 113, 115–116
- proportional hazards model, 78–79, 82–84
- proportional hazards model extensions, 210, 224
- Weibull regression model, 68, 245, 260–273
- frailty models, 298
- Weight functions:
- best subsets selection, 159–160
 - survival function comparisons, 47–50
- Wilcoxon test, survival function comparisons, 47–48, 50, 51, 57, 58
- Worcester Heart Attack Study (WHAS), 2–11, 16, 17, 20, 22, 24, 27, 31, 33, 36, 38–39, 41, 43, 44, 49–51, 55–57, 61, 62–64, 67, 73, 86–87, 95, 96, 98, 101–102, 104, 106, 115–117, 136, 141–153, 157, 161, 162, 163–165, 180, 190–191, 192, 195–198, 207, 209–210, 228–229, 231, 250, 252–253, 255, 258, 264, 268, 277, 282, 299, 303, 346, 348, 350