

References

- [1] S. Yu, S. Leung, M. Heo, G. J. Soto, R. T. Shah, S. Gunda, and M. N. Gong. Comparison of risk prediction scoring systems for ward patients: a retrospective nested case-control study. *Crit Care*, 18(3):R132, 2014. PMID: 24970344.
- [2] H. Wunsch, W. T. Linde-Zwirble, D. C. Angus, M. E. Hartman, E. B. Milbrandt, and J. M. Kahn. The epidemiology of mechanical ventilation use in the United States. *Crit Care Med*, 38(10):1947–1953, Oct 2010. PMID: 20639743.
- [3] V. M. Ranieri, F. Giunta, P. M. Suter, and A. S. Slutsky. Mechanical ventilation as a mediator of multisystem organ failure in acute respiratory distress syndrome. *JAMA*, 284(1):43–44, Jul 2000. PMID: 10872010.
- [4] J. M. Rohde, A. J. Odden, C. Bonham, L. Kuhn, P. N. Malani, L. M. Chen, S. A. Flanders, and T. J. Iwashyna. The epidemiology of acute organ system dysfunction from severe sepsis outside of the intensive care unit. *J Hosp Med*, 8(5):243–247, May 2013. PMID: 23401431.
- [5] M. S. Herridge, A. M. Cheung, C. M. Tansey, A. Matte-Martyn, N. Diaz-Granados, F. Al-Saidi, A. B. Cooper, C. B. Guest, C. D. Mazer, S. Mehta, T. E. Stewart, A. Barr, D. Cook, A. S. Slutsky, and C. C. C. T. G. . One-year outcomes in survivors of the acute respiratory distress syndrome. *N Engl J Med*, 348(8):683–693, Feb 2003. PMID: 12594312.
- [6] K. M. Hillman, P. J. Bristow, T. Chey, K. Daffurn, T. Jacques, S. L. Norman, G. F. Bishop, and G. Simmons. Duration of life-threatening antecedents prior to intensive care admission. *Intensive Care Med*, 28(11):1629–1634, Nov 2002. PMID: 12415452.
- [7] P. McQuillan, S. Pilkington, A. Allan, B. Taylor, A. Short, G. Morgan, M. Nielsen, D. Barrett, G. Smith, and C. H. Collins. Confidential inquiry into quality of care before admission to intensive care. *BMJ*, 316(7148):1853–1858, Jun 1998. PMID: 9632403.
- [8] N. Naeem and H. Montenegro. Beyond the intensive care unit: a review of interventions aimed at anticipating and preventing in-hospital cardiopulmonary arrest. *Resuscitation*, 67(1):13–23, Oct 2005. PMID: 16150531.
- [9] Early Goal-Directed Therapy Collaborative Group. Early goal-directed therapy in the treatment of severe sepsis and septic shock. *N Engl J Med*, 345(19):1368–1377, Nov 2001. PMID: 11794169.
- [10] E. P. Rivers. Early goal-directed therapy in severe sepsis and septic shock: converting science to reality. *Chest*, 129(2):217–218, Feb 2006. PMID: 16478830.
- [11] I. A. Mitchell, H. McKay, C. Van Leuvan, R. Berry, C. McCutcheon, B. Avar, N. Slater, T. Neeman, and P. Lamberth. A prospective controlled trial of the effect of a multi-faceted intervention on early recognition and intervention in deteriorating hospital patients. *Resuscitation*, 81(6):658–666, Jun 2010. PMID: 20378235.
- [12] M. M. Levy, A. Artigas, G. S. Phillips, A. Rhodes, R. Beale, T. Osborn, J.-L. Vincent, S. Townsend, S. Lemeshow, and R. P. Dellinger. Outcomes of the Surviving Sepsis Campaign in intensive care units in the USA and Europe: a prospective cohort study. *Lancet Infect Dis*, 12(12):919–924, Dec 2012. PMID: 23103175.
- [13] Pneumonia Guidelines Committee of the B. T. S Standards of Care Committee. BTS guidelines for the management of community acquired pneumonia in adults: update 2009. *Thorax*, 64 Suppl 3:iii1–ii55, Oct 2009. PMID: 19783532.
- [14] American College of Critical Care Medicine. Clinical practice guidelines for the management of pain, agitation, and delirium in adult patients in the intensive care unit. *Crit Care Med*, 41(1):263–306, Jan 2013. PMID: 23269131.

- [15] T. D. Girard, J. P. Kress, B. D. Fuchs, J. W. W. Thomason, W. D. Schweickert, B. T. Pun, D. B. Taichman, J. G. Dunn, A. S. Pohlman, P. A. Kinniry, J. C. Jackson, A. E. Canonico, R. W. Light, A. K. Shintani, J. L. Thompson, S. M. Gordon, J. B. Hall, R. S. Dittus, G. R. Bernard, and E. W. Ely. Efficacy and safety of a paired sedation and ventilator weaning protocol for mechanically ventilated patients in intensive care (Awakening and Breathing Controlled trial): a randomised controlled trial. *Lancet*, 371(9607):126–134, Jan 2008. PMID: 18191684.
- [16] P. C. Hébert, G. Wells, M. A. Blajchman, J. Marshall, C. Martin, G. Pagliarello, M. Tweeddale, I. Schweitzer, and E. Yetisir. A multicenter, randomized, controlled clinical trial of transfusion requirements in critical care. Transfusion Requirements in Critical Care Investigators, Canadian Critical Care Trials Group. *N Engl J Med*, 340(6):409–417, Feb 1999. PMID: 9971864.
- [17] B. B. Dean, J. Lam, J. L. Natoli, Q. Butler, D. Aguilar, and R. J. Nordyke. Review: use of electronic medical records for health outcomes research: a literature review. *Med Care Res Rev*, 66(6):611–638, Dec 2009. PMID: 19279318.
- [18] R. Amarasingham, B. J. Moore, Y. P. Tabak, M. H. Drazner, C. A. Clark, S. Zhang, W. G. Reed, T. S. Swanson, Y. Ma, and E. A. Halm. An automated model to identify heart failure patients at risk for 30-day readmission or death using electronic medical record data. *Med Care*, 48(11):981–988, Nov 2010. PMID: 20940649.
- [19] C. A. Welch, I. Petersen, J. W. Bartlett, I. R. White, L. Marston, R. W. Morris, I. Nazareth, K. Walters, and J. Carpenter. Evaluation of two-fold fully conditional specification multiple imputation for longitudinal electronic health record data. *Stat Med*, 33(21):3725–3737, Sep 2014. PMID: 24782349.
- [20] L. Smeeth, S. L. Thomas, A. J. Hall, R. Hubbard, P. Farrington, and P. Vallance. Risk of myocardial infarction and stroke after acute infection or vaccination. *N Engl J Med*, 351(25):2611–2618, Dec 2004. PMID: 15602021.
- [21] S. Davé, I. Petersen, L. Sherr, and I. Nazareth. Incidence of maternal and paternal depression in primary care: a cohort study using a primary care database. *Arch Pediatr Adolesc Med*, 164(11):1038–1044, Nov 2010. PMID: 20819960.
- [22] S.-L. Man, I. Petersen, M. Thompson, and I. Nazareth. Antiepileptic drugs during pregnancy in primary care: a UK population based study. *PLoS One*, 7(12):e52339, 2012. PMID: 23272239.
- [23] J. Bafumi and A. Gelman. Fitting Multilevel Models When Predictors and Group Effects Correlate. SSRN Scholarly Paper ID 1010095, Social Science Research Network, Rochester, NY, September 2007.
- [24] B. Efron and C. Morris. Data analysis using Stein’s estimator and its generalizations. *Journal of the American Statistical Association*, 70(350):311–319, 1975.
- [25] A. Gelman, J. B. Carlin, H. S. Stern, and D. B. Rubin. *Bayesian data analysis*, volume 2. Taylor & Francis, 2014.
- [26] A. Gelman. Multilevel (Hierarchical) Modeling: What It Can and Cannot Do. *Technometrics*, 48(3):432–435, August 2006.
- [27] B. Efron and C. N. Morris. Stein’s paradox in statistics. *Scientific American*, 263(5):119–127, 1977.
- [28] B. Efron and C. N. Morris. *Stein’s paradox in statistics*. WH Freeman, 1977.
- [29] D. B. Rubin. Inference and missing data. *Biometrika*, 63(3):581–592, 1976.
- [30] C. B. Hall, R. B. Lipton, M. J. Katz, and C. Wang. Correcting Bias Caused by Missing Data in the Estimate of the Effect of Apolipoprotein epsilon 4 on Cognitive Decline. *J Int Neuropsychol Soc*, pages 1–6, Nov 2014. PMID: 25389642.

- [31] M. J. Daniels, C. Wang, and B. H. Marcus. Fully Bayesian inference under ignorable missingness in the presence of auxiliary covariates. *Biometrics*, 70(1):62–72, Mar 2014. PMID: 24571539.
- [32] C. Wang and C. B. Hall. Correction of bias from non-random missing longitudinal data using auxiliary information. *Stat Med*, 29(6):671–679, Mar 2010. PMID: 20029935.
- [33] X.-L. Meng. Multiple-Imputation Inferences with Uncongenial Sources of Input. *Statist. Sci.*, 9(4):538–558, 11 1994.
- [34] L. M. Collins, J. L. Schafer, and C. M. Kam. A comparison of inclusive and restrictive strategies in modern missing data procedures. *Psychol Methods*, 6(4):330–351, Dec 2001. PMID: 11778676.
- [35] D. B. Rubin. Multiple imputation after 18+ years. *Journal of the American Statistical Association*, 91(434):473–489, 1996.
- [36] M. J. Daniels and J. W. Hogan. *Missing data in longitudinal studies: Strategies for Bayesian modeling and sensitivity analysis*. CRC Press, 2008.
- [37] J. L. Schafer. *Analysis of incomplete multivariate data*. CRC press, 1997.
- [38] J. B. Carlin. Meta-analysis for 2 x 2 tables: a Bayesian approach. *Stat Med*, 11(2):141–158, Jan 1992. PMID: 1349763.
- [39] A. J. Sutton, N. J. Cooper, K. R. Abrams, and A. Ades. *Evidence synthesis for decision making in healthcare*, volume 132. John Wiley & Sons, 2012.
- [40] A. Gelman. *Red state, blue state, rich state, poor state: why Americans vote the way they do*. Princeton University Press, 2009.
- [41] D. Ashby. Bayesian statistics in medicine: a 25 year review. *Stat Med*, 25(21):3589–3631, Nov 2006. PMID: 16947924.
- [42] D. J. Spiegelhalter, J. P. Myles, D. R. Jones, and K. R. Abrams. Bayesian methods in health technology assessment: a review. *Health Technol Assess*, 4(38):1–130, 2000. PMID: 11134920.
- [43] B. Efron. *Large-scale inference: empirical Bayes methods for estimation, testing, and prediction*, volume 1. Cambridge University Press, 2013.
- [44] C. Yoo, L. Ramirez, and J. Liuzzi. Big data analysis using modern statistical and machine learning methods in medicine. *Int Neurourol J*, 18(2):50–57, Jun 2014. PMID: 24987556.
- [45] B. E. Himes, Y. Dai, I. S. Kohane, S. T. Weiss, and M. F. Ramoni. Prediction of chronic obstructive pulmonary disease (COPD) in asthma patients using electronic medical records. *J Am Med Inform Assoc*, 16(3):371–379, 2009. PMID: 19261943.
- [46] O.-P. Ryyänänen, E. J. Soini, A. Lindqvist, M. Kilpeläinen, and T. Laitinen. Bayesian predictors of very poor health related quality of life and mortality in patients with COPD. *BMC Med Inform Decis Mak*, 13:34, 2013. PMID: 23496851.
- [47] J. Wu, J. Roy, and W. F. Stewart. Prediction modeling using EHR data: challenges, strategies, and a comparison of machine learning approaches. *Med Care*, 48(6 Suppl):S106–S113, Jun 2010. PMID: 20473190.
- [48] J. K. Kruschke. Bayesian estimation supersedes the t test. *J Exp Psychol Gen*, 142(2):573–603, May 2013. PMID: 22774788.
- [49] J. Kruschke. *Doing Bayesian data analysis: A tutorial introduction with R*. Academic Press, 2014.

- [50] M. Bayes and M. Price. An essay towards solving a problem in the doctrine of chances. by the late rev. mr. bayes, frs communicated by mr. price, in a letter to john canton, amfrs. *Philosophical Transactions (1683-1775)*, pages 370–418, 1763.
- [51] A. Gelman et al. Prior distributions for variance parameters in hierarchical models (comment on article by Browne and Draper). *Bayesian analysis*, 1(3):515–534, 2006.
- [52] E.-J. Wagenmakers, M. Lee, T. Lodewyckx, and G. J. Iverson. Bayesian versus frequentist inference. In *Bayesian evaluation of informative hypotheses*, pages 181–207. Springer, 2008.
- [53] B. Efron. *Modern science and the Bayesian-frequentist controversy*. Division of Biostatistics, Stanford University, 2005.
- [54] K. Abrams and B. Sansó. Approximate Bayesian inference for random effects meta-analysis. *Stat Med*, 17(2):201–218, Jan 1998. PMID: 9483729.
- [55] Stan Development Team. Stan: A C++ Library for Probability and Sampling, Version 2.5.0, 2014.
- [56] N. Metropolis and S. Ulam. The monte carlo method. *Journal of the American statistical association*, 44(247):335–341, 1949.
- [57] M. D. Homan and A. Gelman. The no-U-turn sampler: Adaptively setting path lengths in Hamiltonian Monte Carlo. *The Journal of Machine Learning Research*, 15(1):1593–1623, 2014.
- [58] M. M. Duncan, P. A. McIntosh, C. D. Stayton, and C. B. Hall. Individualized performance feedback to increase prenatal domestic violence screening. *Matern Child Health J*, 10(5):443–449, Sep 2006. PMID: 16710766.
- [59] D. A. Davis, M. A. Thomson, A. D. Oxman, and R. B. Haynes. Changing physician performance. A systematic review of the effect of continuing medical education strategies. *JAMA*, 274(9):700–705, Sep 1995. PMID: 7650822.
- [60] M. Campbell, R. Fitzpatrick, A. Haines, A. L. Kinmonth, P. Sandercock, D. Spiegelhalter, and P. Tyrer. Framework for design and evaluation of complex interventions to improve health. *BMJ*, 321(7262):694–696, Sep 2000. PMID: 10987780.
- [61] B. S. Mittman. Creating the evidence base for quality improvement collaboratives. *Ann Intern Med*, 140(11):897–901, Jun 2004. PMID: 15172904.
- [62] R. E. Glasgow and K. M. Emmons. How can we increase translation of research into practice? Types of evidence needed. *Annu Rev Public Health*, 28:413–433, 2007. PMID: 17150029.
- [63] P. Selby, G. Brosky, P. I. Oh, V. Raymond, and S. Ranger. How pragmatic or explanatory is the randomized, controlled trial? The application and enhancement of the PRECIS tool to the evaluation of a smoking cessation trial. *BMC Med Res Methodol*, 12:101, 2012. PMID: 22824225.
- [64] G. Tosh, K. Soares-Weiser, and C. E. Adams. Pragmatic vs explanatory trials: the pragmascope tool to help measure differences in protocols of mental health randomized controlled trials. *Dialogues Clin Neurosci*, 13(2):209–215, 2011. PMID: 21842618.
- [65] H. E. Kenz and P. Van der Linden. Transfusion-related acute lung injury. *Eur J Anaesthesiol*, 31(7):345–350, Jul 2014. PMID: 24892308.
- [66] D. S. Likosky, D. C. FitzGerald, R. C. Groom, D. K. Jones, R. A. Baker, K. G. Shann, C. D. Mazer, B. D. Spiess, and S. C. Body. Effect of the perioperative blood transfusion and blood conservation in cardiac surgery clinical practice guidelines of the Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists upon clinical practices. *Anesth Analg*, 111(2):316–323, Aug 2010. PMID: 20488928.

- [67] C. H. Weiss, F. Moazed, C. A. McEvoy, B. D. Singer, I. Szleifer, L. A. N. Amaral, M. Kwasny, C. M. Watts, S. D. Persell, D. W. Baker, J. I. Sznajder, and R. G. Wunderink. Prompting physicians to address a daily checklist and process of care and clinical outcomes: a single-site study. *Am J Respir Crit Care Med*, 184(6):680–686, Sep 2011. PMID: 21616996.
- [68] A. Gelman, Y. Goegebeur, F. Tuerlinckx, and I. Van Mechelen. Diagnostic Checks for Discrete Data Regression Models Using Posterior Predictive Simulations. *Applied Statistics*, pages 247–268, 2000.
- [69] shinyStan Team. shinyStan: R Package for Interactive Exploration of Markov Chain Monte Carlo Output, Version 0.1, 2015.
- [70] A. Gelman. Exploratory data analysis for complex models. *Journal of Computational and Graphical Statistics*, 13(4), 2004.
- [71] A. Gelman, X.-L. Meng, and H. Stern. Posterior predictive assessment of model fitness via realized discrepancies. *Statistica sinica*, 6(4):733–760, 1996.
- [72] A. Buja, D. Cook, and D. Swayne. Inference for data visualization. In *Talk given at Joint Statistical Meetings*, 1999.
- [73] E. R. DeLong, D. M. DeLong, and D. L. Clarke-Pearson. Comparing the areas under two or more correlated receiver operating characteristic curves: a nonparametric approach. *Biometrics*, 44(3):837–845, Sep 1988. PMID: 3203132.
- [74] P. J. Newcombe, B. H. Reck, J. Sun, G. T. Platek, C. Verzilli, A. K. Kader, S.-T. Kim, F.-C. Hsu, Z. Zhang, S. L. Zheng, V. E. Mooser, L. D. Condreay, C. F. Spraggs, J. C. Whittaker, R. S. Rittmaster, and J. Xu. A comparison of Bayesian and frequentist approaches to incorporating external information for the prediction of prostate cancer risk. *Genet Epidemiol*, 36(1):71–83, Jan 2012. PMID: 22890972.
- [75] A. Vehtari and J. Lampinen. Bayesian model assessment and comparison using cross-validation predictive densities. *Neural Comput*, 14(10):2439–2468, Oct 2002. PMID: 12396570.
- [76] A. Gelman, J. Hwang, and A. Vehtari. Understanding predictive information criteria for Bayesian models. *Statistics and Computing*, 24(6):997–1016, 2014.
- [77] W. Wang and A. Gelman. Difficulty of selecting among multilevel models using predictive accuracy, 2014.
- [78] P. Congdon. Bayesian predictive model comparison via parallel sampling. *Computational statistics & data analysis*, 48(4):735–753, 2005.
- [79] J. L. Huntington and A. Dueck. Handling missing data. *Curr Probl Cancer*, 29(6):317–325, 2005. PMID: 16311133.
- [80] J. A. Sloan and A. Dueck. Issues for statisticians in conducting analyses and translating results for quality of life end points in clinical trials. *J Biopharm Stat*, 14(1):73–96, Feb 2004. PMID: 15027501.
- [81] A. Gelman, G. King, and C. Liu. Not asked and not answered: Multiple imputation for multiple surveys. *Journal of the American Statistical Association*, 93(443):846–857, 1998.
- [82] J. L. Cook, K. L. Grady, M. Colvin, S. M. Joseph, M. A. Brisco, M. N. Walsh, and f. t. g. A. D. W. G. . Sex Differences in the Care of Patients With Advanced Heart Failure. *Circ Cardiovasc Qual Outcomes*, Feb 2015. PMID: 25714825.
- [83] L. T. Goodnough, J. H. Levy, and M. F. Murphy. Concepts of blood transfusion in adults. *Lancet*, 381(9880):1845–1854, May 2013. PMID: 23706801.

- [84] T. R. Vetter, A. M. Boudreaux, K. A. Jones, J. M. Hunter, Jr, and J.-F. Pittet. The perioperative surgical home: how anesthesiology can collaboratively achieve and leverage the triple aim in health care. *Anesth Analg*, 118(5):1131–1136, May 2014. PMID: 24781579.
- [85] M. H. Andreae and D. A. Andreae. Regional anaesthesia to prevent chronic pain after surgery: a Cochrane systematic review and meta-analysis. *Br J Anaesth*, 111(5):711–720, Nov 2013. PMCID: PMC3793661.
- [86] R. Kaushal, G. Hripcsak, D. D. Ascheim, T. Bloom, T. R. Campion, Jr, A. L. Caplan, B. P. Currie, T. Check, E. L. Deland, M. N. Gourevitch, R. Hart, C. R. Horowitz, I. Kastenbaum, A. A. Levin, A. F. H. Low, P. Meissner, P. Mirhaji, H. A. Pincus, C. Scaglione, D. Shelley, J. N. Tobin, and N. Y. C.-C. D. R. N. . Changing the research landscape: the New York City Clinical Data Research Network. *J Am Med Inform Assoc*, 21(4):587–590, 2014. PMID: 24821739.