References

Balke A and Pearl J 1994a Counterfactual probabilities: Computational methods, bounds, and applications. In *Uncertainty in Artificial Intelligence 10* (ed. de Mantaras RL and Poole D) Morgan Kaufmann Publishers, San Mateo, CA pp. 46–54.

Balke A and Pearl J 1994b Probabilistic evaluation of counterfactual queries. *Proceedings of the Twelfth National Conference on Artificial Intelligence*, vol. **I**, MIT Press, Menlo Park, CA pp. 230–237.

Bareinboim E and Pearl J 2012 Causal inference by surrogate experiments (or, *z*-identifiability). *Proceedings of the Twenty-eighth Conference on Uncertainty in Artificial Intelligence* (ed. de Freitas N and Murphy K) AUAI Press, Corvallis, OR, pp. 113–120.

Bareinboim E and Pearl J 2013 A general algorithm for deciding transportability of experimental results. *Journal of Causal Inference* **1** (1), 107–134.

Bareinboim E and Pearl J 2016 Causal inference and the data-fusion problem. *Proceedings of the National Academy of Sciences* **113** (17), 7345–7352.

Bareinboim E, Tian J and Pearl J 2014 Recovering from selection bias in causal and statistical inference. *Proceedings of the Twenty-eighth AAAI Conference on Artificial Intelligence* (ed. Brodley CE and Stone P) AAAI Press, Palo Alto, CA, pp. 2410–2416.

Baron R and Kenny D 1986 The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* **51** (6), 1173–1182.

Berkson J 1946 Limitations of the application of fourfold table analysis to hospital data. *Biometrics Bulletin* **2**, 47–53.

Bollen K 1989 *Structural Equations with Latent Variables*. John Wiley & Sons, Inc., New York.

Bollen K and Pearl J 2013 Eight myths about causality and structural equation models. In *Handbook of Causal Analysis for Social Research* (ed. Morgan S) Springer-Verlag, Dordrecht, Netherlands pp. 245–274.

Bowden R and Turkington D 1984 *Instrumental Variables*. Cambridge University Press, Cambridge, England.

Brito C and Pearl J 2002 Generalized instrumental variables. *Uncertainty in Artificial Intelligence, Proceedings of the Eighteenth Conference* (ed. Darwiche A and Friedman N) Morgan Kaufmann San Francisco, CA pp. 85–93.

Cai Z and Kuroki M 2006 Variance estimators for three 'probabilities of causation'. *Risk Analysis* **25** (6), 1611–1620.

Chen B and Pearl J 2014 *Graphical tools for linear structural equation modeling*. Technical Report R-432, Department of Computer Science, University of California, Los Angeles, CA. Submitted, Psychometrika, http://ftp.cs.ucla.edu/pub/stat_ser/r432.pdf.

Cole S and Hernán M 2002 Fallibility in estimating direct effects. *International Journal of Epidemiology* **31** (1), 163–165.

Conrady S and Jouffe L 2015 *Bayesian Networks and BayesiaLab: A Practical Introduction for Researchers* 1st edition edn. Bayesia USA.

Cox D 1958 *The Planning of Experiments*. John Wiley and Sons, New York.

Darwiche A 2009 *Modeling and Reasoning with Bayesian Networks*. Cambridge University Press, New York.

Duncan O 1975 *Introduction to Structural Equation Models*. Academic Press, New York.

Elwert F 2013 Graphical causal models. In *Handbook of Causal Analysis for Social Research* (ed. Morgan S) Springer-Verlag, Dordrecht, Netherlands pp. 245–274.

Fenton N and Neil M 2013 *Risk Assessment and Decision Analysis with Bayesian Networks*. CRC Press, Boca Raton, FL.

Fisher R 1922 On the mathematical foundations of theoretical statistics. *Philosophical Transactions of the Royal Society of London, Series A* **222**, 311.

Fisher B, Anderson S, Bryant J, Margolese RG, Deutsch M, Fisher ER, Jeong JH and Wolmark N 2002 Twenty-year follow-up of a randomized trial comparing total mastectomy, lumpectomy, and lumpectomy plus irradiation for the treatment of invasive breast cancer. *New England Journal of Medicine* **347** (16), 1233–1241.

Glymour MM 2006 Using causal diagrams to understand common problems in social epidemiology. *Methods in Social Epidemiology* John Wiley & Sons, Inc., San Francisco, CA pp. 393–428.

Glymour M and Greenland S 2008 Causal diagrams. In *Modern Epidemiology* (ed. Rothman K, Greenland S, and Lash T) 3rd edn. Lippincott Williams & Wilkins Philadelphia, PA pp. 183–209.

Greenland S 1999 Relation of probability of causation, relative risk, and doubling dose: A methodologic error that has become a social problem. *American Journal of Public Health* **89** (8), 1166–1169.

Greenland S 2000 An introduction to instrumental variables for epidemiologists. *International Journal of Epidemiology* **29** (4), 722–729.

Grinstead CM and Snell JL 1998 *Introduction to Probability* second revised edn. American Mathematical Society, United States.

Haavelmo T 1943 The statistical implications of a system of simultaneous equations. *Econometrica* **11**, 1–12. Reprinted in DF Hendry and MS Morgan (Eds.), 1995 *The Foundations of Econometric Analysis*, Cambridge University Press pp. 477–490.

Hayduk L, Cummings G, Stratkotter R, Nimmo M, Grygoryev K, Dosman D, Gilespie, M., Pazderka-Robinson H and Boadu K 2003 Pearl's *d*-separation: One more step into causal thinking. *Structural Equation Modeling* **10** (2), 289–311.

Heise D 1975 *Causal Analysis*. John Wiley and Sons, New York.

Hernán M and Robins J 2006 Estimating causal effects from epidemiological data. *Journal of Epidemiology and Community Health* **60** (7), 578–586. DOI: 10.1136/jech.2004.029496.

Hernández-Díaz S, Schisterman E and Hernán M 2006 The birth weight "paradox" uncovered? *American Journal of Epidemiology* **164** (11), 1115–1120.

Holland P 1986 Statistics and causal inference. *Journal of the American Statistical Association* **81** (396), 945–960.

Howard R and Matheson J 1981 Influence diagrams. In *Principles and Applications of Decision Analysis* (ed. Howard R and Matheson J) Strategic Decisions Group, Menlo Park, CA pp.721–762.

Imai K, Keele L and Yamamoto T 2010 Identification, inference, and sensitivity analysis for causal mediation effects. *Statistical Science* **25** (1), 51–71.

Jewell NP 2004 *Statistics for Epidemiology*. Chapman & Hall/CRC, Boca Raton, FL.

Kenny D 1979 *Correlation and Causality*. John Wiley & Sons, Inc., New York.

Kiiveri H, Speed T and Carlin J 1984 Recursive causal models. *Journal of Australian Math Society* **36**, 30–52.

Kim J and Pearl J 1983 A computational model for combined causal and diagnostic reasoning in inference systems. *Proceedings of the Eighth International Joint Conference on Artificial Intelligence (IJCAI-83)*, pp. 190–193, Karlsruhe, Germany.

Kline RB 2016 *Principles and Practice of Structural Equation Modeling* fourth: Revised and expanded edn. Guilford Publications, Inc., New York.

Koller K and Friedman N 2009 *Probabilistic Graphical Models: Principles and Techniques*. MIT Press, United States.

Kyono T 2010 *Commentator: A front-end user-interface module for graphical and structural equation modeling.* Master's thesis Department of Computer Science, University of California, Los Angeles, CA.

Lauritzen S 1996 *Graphical Models*. Clarendon Press, Oxford. Reprinted 2004 with corrections.

Lewis D 1973 Causation. *Journal of Philosophy* **70**, 556–567.

Lindley DV 2014 *Understanding Uncertainty* revised edn. John Wiley & Sons, Inc., Hoboken, NJ.

Lord FM 1967 A paradox in the interpretation of group comparisons. *Psychological Bulletin* **68**, 304–305.

Mohan K, Pearl J and Tian J 2013 Graphical models for inference with missing data. In *Advances in Neural Information Processing Systems 26* (ed. Burges C, Bottou L, Welling M, Ghahramani Z and Weinberger K) Neural Information Processing Systems Foundation, Inc. pp. 1277–1285.

Moore D, McCabe G and Craig B 2014 *Introduction to the Practice of Statistics*. W.H. Freeman & Co., New York.

Morgan SL and Winship C 2014 *Counterfactuals and Causal Inference: Methods and Principles for Social Research*, *Analytical Methods for Social Research* 2nd edn. Cambridge University Press, New York.

Muthén B and Asparouhov T 2015 Causal effects in mediation modeling: An introduction with applications to latent variables. *Structural Equation Modeling: A Multidisciplinary Journal* **22** (1), 12–23.

Neyman J 1923 On the application of probability theory to agricultural experiments. Essay on principles. Section 9. *Statistical Science* **5** (4), 465–480.

Pearl J 1985 Bayesian networks: A model of self-activated memory for evidential reasoning. *Proceedings, Cognitive Science Society*, pp. 329–334, Irvine, CA.

Pearl J 1986 Fusion, propagation, and structuring in belief networks. *Artificial Intelligence* **29**, 241–288.

Pearl J 1988 *Probabilistic Reasoning in Intelligent Systems*. Morgan Kaufmann, San Mateo, CA.

Pearl J 1993 Comment: Graphical models, causality, and intervention. *Statistical Science* **8** (3), 266–269.

Pearl J 1995 Causal diagrams for empirical research. *Biometrika* **82** (4), 669–710.

Pearl J 1998 Graphs, causality, and structural equation models. *Sociological Methods and Research* **27** (2), 226–284.

Pearl J 2000 *Causality: Models, Reasoning, and Inference*. Cambridge University Press, New York.

Pearl J 2001 Direct and indirect effects. *Proceedings of the Seventeenth Conference on Uncertainty in Artificial Intelligence* Morgan Kaufmann San Francisco, CA pp. 411–420.

Pearl J 2009 *Causality: Models, Reasoning, and Inference* 2nd edn. Cambridge University Press, New York.

Pearl J 2014a Interpretation and identification of causal mediation. *Psychological Methods* **19**, 459–481.

Pearl J 2014b Understanding Simpson's paradox. *The American Statistician* **88** (1), 8–13.

Pearl J 2015a Causes of effects and effects of causes. *Journal of Sociological Methods and Research* **44**, 149–164.

Pearl J 2015b Detecting latent heterogeneity. *Sociological Methods and Research* DOI: 10.1177/0049124115600597, online:1–20.

Pearl J 2015c Trygve Haavelmo and the emergence of causal calculus. *Econometric Theory*, Special issue on Haavelmo Centennial **31** (1), 152–179.

Pearl J 2016 *Lord's paradox revisited—(oh Lord! Kumbaya!). Journal of Causal Inference* **4** (2). DOI: 10.1515/jci-2016-0021.

Pearl J and Bareinboim E 2014 External validity: From *do*-calculus to transportability across populations. *Statistical Science* **29** ,579–595.

Pearl J and Mackenzie D 2018 *The Book of Why: The New Science of Cause and Effect.* Basic Books, New York.

Pearl J and Paz A 1987 GRAPHOIDS: A graph-based logic for reasoning about relevance relations. In *Advances in Artificial Intelligence-II* (ed. Duboulay B, Hogg D and Steels L) North-Holland Publishing Co. pp. 357–363.

Pearl J and Robins J 1995 Probabilistic evaluation of sequential plans from causal models with hidden variables. In *Uncertainty in Artificial Intelligence 11* (ed. Besnard P and Hanks S) Morgan Kaufmann, San Francisco, CA pp. 444–453.

Pearl J and Verma T 1991 A theory of inferred causation. *Principles of Knowledge Representation and Reasoning: Proceedings of the Second International Conference* (ed. Allena J, Fikes R and Sandewall E) Morgan Kaufmann San Mateo, CA pp. 441–452.

Pigou A 1911 *Alcoholism and Heredity*. Westminster Gazette. February 2.

Rebane G and Pearl J 1987 The recovery of causal poly-trees from statistical data. *Proceedings of the Third Workshop on Uncertainty in AI*, pp. 222–228, Seattle, WA.

Reichenbach H 1956 *The Direction of Time*. University of California Press, Berkeley, CA.

Robertson D 1997 The common sense of cause in fact. *Texas Law Review* **75** (7), 1765–1800.

Robins J 1986 A new approach to causal inference in mortality studies with a sustained exposure period—applications to control of the healthy workers survivor effect. *Mathematical Modeling* **7**, 1393–1512.

Robins J and Greenland S 1992 Identifiability and exchangeability for direct and indirect effects. *Epidemiology* **3** (2), 143–155.

Rubin D 1974 Estimating causal effects of treatments in randomized and nonrandomized studies. *Journal of Educational Psychology* **66**, 688–701.

Selvin S 2004 *Biostatistics: How it Works*. Pearson, New Jersey.

Senn S 2006 Change from baseline and analysis of covariance revisited. *Statistics in Medicine* **25**, 4334–4344.

Shpitser I 2013 Counterfactual graphical models for longitudinal mediation analysis with unobserved confounding. *Cognitive Science* **37** (6), 1011–1035.

Shpitser I and Pearl J 2007 What counterfactuals can be tested. *Proceedings of the Twenty-Third Conference on Uncertainty in Artificial Intelligence* AUAI Press Vancouver, BC, Canada pp. 352–359. Also, *Journal of Machine Learning Research* **9**, 1941–1979, 2008.

Shpitser I and Pearl J 2008 Complete identification methods for the causal hierarchy. *Journal of Machine Learning Research* **9**, 1941–1979.

Shpitser I and Pearl J 2009 Effects of treatment on the treated: Identification and generalization. *Proceedings of the Twenty-Fifth Conference on Uncertainty in Artificial Intelligence* AUAI Press Montreal, Quebec pp. 514–521.

Simon H 1953 Causal ordering and identifiability. In *Studies in Econometric Method* (ed. Hood WC and Koopmans T) John Wiley & Sons, Inc. New York pp. 49–74.

Simpson E 1951 The interpretation of interaction in contingency tables. *Journal of the Royal Statistical Society, Series B* **13**, 238–241.

Spirtes P and Glymour C 1991 An algorithm for fast recovery of sparse causal graphs. *Social Science Computer Review* **9** (1), 62–72.

Spirtes P, Glymour C and Scheines R 1993 *Causation, Prediction, and Search.* Springer-Verlag, New York.

Stigler SM 1999 *Statistics on the Table: The History of Statistical Concepts and Methods*. Harvard University Press, Cambridge, MA, Hoboken, NJ.

Strotz R and Wold H 1960 Recursive versus nonrecursive systems: An attempt at synthesis. *Econometrica* **28**, 417–427.

Textor J, Hardt J and Knuüppel S 2011 DAGitty: A graphical tool for analyzing causal diagrams. *Epidemiology* **22** (5), 745.

Tian J, Paz A and Pearl J 1998 *Finding minimal d-separators*. Technical Report R-254, Department of Computer Science, University of California, Los Angeles, CA. http://ftp.cs.ucla.edu/pub/stat_ser/r254 .pdf.

Tian J and Pearl J 2000 Probabilities of causation: bounds and identification. *Annals of Mathematics and Artificial Intelligence* **28**, 287–313.

Tian J and Pearl J 2002 A general identification condition for causal effects. *Proceedings of the Eighteenth National Conference on Artificial Intelligence* AAAI Press/The MIT Press Menlo Park, CA pp. 567–573.

VanderWeele T 2015 *Explanation in Causal Inference: Methods for Mediation and Interaction*. Oxford University Press, New York.

Verma T and Pearl J 1988 Causal networks: Semantics and expressiveness. *Proceedings of the Fourth Workshop on Uncertainty in Artificial Intelligence*, pp. 352–359, Mountain View, CA. Also in R. Shachter, T.S. Levitt, and L.N. Kanal (Eds.), *Uncertainty in AI 4*, Elsevier Science Publishers, 69–76, 1990.

Verma T and Pearl J 1990 Equivalence and synthesis of causal models. *Proceedings of the Sixth Conference on Uncertainty in Artificial Intelligence*, pp. 220–227, Cambridge, MA.

Virgil 29 BC Georgics. Verse 490, Book 2.

Wainer H 1991 Adjusting for differential base rates: Lord's paradox again. *Psychological Bulletin* **109**, 147–151.

Wooldridge J 2013 Introductory Econometrics: A Modern Approach 5th international edn. South-Western, Mason, OH.