Statistical tests and multiple testing

Teacher
Prof. Dr. Markus Neuhäuser
RheinAhrCampus, Joseph-Rovan-Allee 2, DE - 53424 Remagen, Germany

Course Website (optional)
https://classroom.google.com/
Code: to be added if online course is also available

Course description (min 150, max 300 words)
The course starts with a description how statistical hypotheses can be tested. Basic concepts of statistical tests including null hypotheses, error types, power and p-values are introduced. The relationship between statistical tests and confidence intervals is discussed. Common statistical tests for continuous and categorical data such as t tests and chi² tests are presented with a focus to two-sample comparisons. Nonparametric and exact tests are also discussed, in particular permutation tests based on ranks. The Behrens-Fisher problem, that is the question of how to analyse a data set when variances are unequal is also briefly considered.
If there is enough time testing of multiple hypotheses is considered, that is how error probabilities can be controlled when several tests are carried out simultaneously. In addition to the classical Bonferroni correction several stepwise procedures could be presented such as the Bonferroni–Holm method and other closed testing procedures.
Example data and R code is presented.

Course period
April 2024

SSD
MAT/06, MAT/08

Course References (optional)

Credits and Hours
1 credit, one hour lectures (8 hours = 1 credit)

Exam Modality
 Two alternatives are available to the student to pass this exam (Teacher(s) may choose other modalities):
1) Paper presentation. Students present the content of 2 papers suggested by the teacher. No groups are allowed.

2) Project. Students implement and experimentally validate an algorithm or its variation from a paper suggested by the teacher. Projects can be done in groups of 1-3 students, depending on the algorithm.

Teacher CV
Attach or link a max 3 pages CV for each teacher proposing the course.

Teacher Main Publications
List 10 main publications in the last 15 years for each teacher.

CV

Personal Details

Name:	Markus Neuhäuser
Address (office):	Department of Mathematics and Technology,
	RheinAhrCampus, Koblenz University of Applied Sciences,
	Joseph-Rovan-Allee 2, 53424 Remagen, Germany
	e-mail: neuhaeuser@rheinahrcampus.de
(home):	Marienburg 19, 51503 Rösrath, Germany
Date of birth:	29/Nov/1968

Education

1988:	High School graduation (Abitur)
Oct. 1988 – Dec. 1993:	Student, Technical University of Dortmund, Germany
	Subjects: statistics, biology (minor)
Oct. 1989 – Dec. 1993:	Scholarship holder, Hanns-Seidel-Foundation, Munich, Germany
Dec. 1993:	Diploma in statistics
	Faculty of Statistics, Technical University of Dortmund
Sep. 1996:	Doctorate (Dr. rer. nat.)
	Faculty of Statistics, Technical University of Dortmund
Sep. 2001:	Certificate „Biometry in Medicine"
	awarded from the GMDS and the German Region of the International Biometric Society
Semester II, 2003	Teaching Development Programme for Early Career Science Academics,
	Higher Education Development Centre, University of Otago, Dunedin, New Zealand
July 2004:	Habilitation in biometry
	Faculty of Statistics, Technical University of Dortmund

Job experience

Oct. 1991 – May 1993:	Student assistant, Computer Center, Techn. University of Dortmund
Jan. 1994 – Feb. 1996:	Scientific assistant and PhD student,
	Faculty of Science, Leibniz University Hannover, Germany
March 1996 – Dec. 2001:	Biostatistician in pharmaceutical companies
	Solvay Pharmaceuticals (Hannover, Germany)
	Byk Gulden/Altana Pharmaceuticals (Konstanz, Germany)
Jan. 2002 – Feb. 2004:	Senior Lecturer,
	Dept. of Mathematics and Statistics, University of Otago, New Zealand
March 2004 – Aug. 2006:	Head of the working group „Biometry and Bioinformatics",
	Institute of Medical Informatics, Biometry and Epidemiology,
	University Hospital Essen, Germany
since Sept. 2006:	Professor of statistics
	Dept. of Mathematics and Technology, RheinAhrCampus,
	Koblenz University of Applied Sciences, Remagen, Germany

Further issues

Associate Editor: *Communications in Statistics – Simulation and Computation* (since 2003)
Communications in Statistics – Theory and Methods (since 2003)
Journal of Statistical Computation and Simulation (since 2008)
Communications in Statistics – Case Studies, Data Analysis and Applications (since 2015)

Visiting Professor, University of Western Sydney, Australia (Jan./Feb. 2011)

Speaker working group „Nonparametric methods" of the German Region of the International Biometric Society (2005–2008)

Board member, German Region of the International Biometric Society (2010/11, 2015-19)

Member ethics committee, State Chamber of Physicians Rhineland-Palatinate (since 2022)

Remagen, 14/Jan/2024

Markus Neuhäuser: List of publications

(December 2023)

<u>(a) Books</u>

1. Pewsey, A., **Neuhäuser, M.** & Ruxton, G.D. (2013): *Circular Statistics in R*. Oxford University Press, Oxford.
2. **Neuhäuser, M.** (2012): *Nonparametric statistical tests: A computational approach*. CRC Press (Chapman & Hall), Boca Raton.
3. **Neuhäuser, M.** (2010): *Computer-intensive und nichtparametrische statistische Tests*. Oldenbourg-Verlag, München.

<u>(b) Review papers</u>

4. Ruxton, G.D. & **Neuhäuser, M.** (2010): Good practice in testing for an association in contingency tables. *Behavioral Ecology and Sociobiology* 64, 1505-1513.
5. **Neuhäuser, M.** (2006): How to deal with multiple endpoints in clinical trials. *Fundamental and Clinical Pharmacology* 20, 515-523.
6. Boes, T. & **Neuhäuser, M.** (2005): Normalization for Affymetrix GeneChips. *Methods of Information in Medicine* 44, 414-417.
7. **Neuhäuser, M.** (2005): Exact tests based on the Baumgartner-Weiß-Schindler statistic – a survey. *Statistical Papers* 46, 1-30.
8. **Neuhäuser, M.** (2001): An adaptive interim analysis - a useful tool for ecological studies. *Basic and Applied Ecology* 2, 203-207.

<u>(c) Journal papers</u>

9. **Neuhäuser, M.**, Mackowiak, M.M. & Ruxton, G.D. (2021): Unequal sample sizes according to the square-root allocation rule are useful when comparing several treatments with a control. *Ethology* 127, 1094-1100.
10. Humphreys, R.K., **Neuhäuser, M.** & Ruxton, G.D. (2021): Turn alternation and the influence of environmental factors on search routes through branched structures by ladybirds (*Coccinella septempunctata* and *Adalia bipunctata*). *Behavioural Processes* 182, article 104292.
11. Schenk, A., **Neuhäuser, M.**, Ruxton, G.D. & Bathke, A.C. (2021): Predictors of pre-European deforestation on Pacific islands: a re-analysis using modern multivariate non-parametric statistical methods. *Forest Ecology and Management* 493, 119238.
12. Thielmann, M., Wendt, D., Slottosch, I., Welp, H., Schiller, S., Tsagakis, K., Schmack, B., Weymann, A., Martens, S., **Neuhäuser, M.** et al. (2021): Coronary artery bypass graft surgery in patients with acute coronary syndromes after primary percutaneous coronary intervention: A current report

from the North Rhine Westphalia surgical myocardial infarction registry. *Journal of the American Heart Association* 10:e021182.

13. Haidari, Z., Wendt, D., Thielmann, M., Mackowiak, M., **Neuhäuser, M.**, Jakob, H. et al. (2020): Intraoperative hemoadsorption in patients with native mitral valve infective endocarditis. *Annals of Thoracic Surgery* 110, 890-896.

14. Liakopoulos, O.J., Slottosch, I., Wendt, D., Welp, H., Schiller, W., Martens, S., Choi, Y.H., Welz, A., Pisarenko, J., **Neuhäuser, M.** et al. (2020): Surgical revascularization for acute coronary syndromes: a report from the North-Rhine-Westphalia surgical myocardial infarction registry. *European Journal of Cardio-thoracic Surgery* 58, 1137-1144.

15. **Neuhäuser, M.**, Krächter, J.M., Thielmann, M. & Ruxton, G.D. (2020): Substantially inflated type I error rates if propensity score method is not fixed in advance. *Communications in Statistics: Case Studies, Data Analysis and Applications* 6, 307-313.

16. Humphreys, R.K., Puth, M.T., **Neuhäuser, M.** & Ruxton, G.D. (2019): Underestimation of Pearson's product moment correlation statistic. *Oecologica* 189, 1-7.

17. Liakopoulos, O.J., Schlachtenberger, G., Wendt, D., Choi, Y.H., Slottosch, I., Welp, H., Schiller, W., Martens, S., Welz, A., **Neuhäuser, M.** et al. (2019): Early clinical outcomes of surgical myocardial revascularization for acute coronary syndromes complicated by cardiogenic shock: A report from the North-Rhine-Westphalia surgical myocardial infarction registry. *Journal of the American Heart Association* 21, 8(10): e012049.

18. **Neuhäuser, M.**, Thielmann, T. & Ruxton, G.D. (2018): The number of strata in propensity score stratification for a binary outcome. *Archives of Medical Science* 14, 695-700.

19. Ruxton, G.D. & **Neuhäuser, M.** (2018): Invited Debate: Striving for simple but effective advice for comparing the central tendency of two populations. *Journal of Modern Applied Statistical Methods* 17, eP2567.

20. Sotiropoulos, G.C., Spartalis, E., Machairas, N., Paul, A., Malagó, M. & **Neuhäuser, M.** (2018): Liver transplantation for hepatocellular carcinoma with live donors or extended criteria donors: a propensity score-matched comparison. *Annals of Gastroenterology* 31, 722-727.

21. Welz, A., Ruxton, G.D. & **Neuhäuser, M.** (2018): A non-parametric maximum test for the Behrens–Fisher problem. *Journal of Statistical Computation and Simulation* 88, 1336-1347.

22. Botker, H.E., Hausenloy, D., Andreadou, I., Antonucci, S., Boengler, K., Davidson, S.M., Deshwal, S., Devaux, Y., Di Lisa, F., Di Sante, M., Efentakis, P., Femmino, S., Garcia-Dorado, D., Giricz, Z., Ibanez, B., Iliodromitis, E., Kaludercic, N, Kleinbongard, P., **Neuhäuser, M.**, et al. (2018): Practical guidelines for rigor and reproducibility in preclinical and clinical studies on cardioprotection. *Basic Research in Cardiology* 113, 39.

23. Skyschally, A., Amanakis, G., **Neuhäuser, M.**, Kleinbongard, P. & Heusch, G. (2017): Impact of electrical defibrillation on infarct size and no-reflow in

pigs subjected to myocardial ischemia/reperfusion without and with ischemic conditioning. *American Journal of Physiology - Heart and Circulatory Physiology* 313, H871-H878.

24. **Neuhäuser, M.**, Welz, A. & Ruxton, G.D. (2017): Statistical tests for the comparison of two samples: The general alternative. *Communications in Statistics - Simulation and Computation* 46, 903-909.

25. Kahlert, P., Hildebrandt, H.A., Patsalis, P.C., Al-Rashid, F., Jánosi, R.A., Nensa, F., Schlosser, T.W., Schlamann, M., Wendt, D., Thielmann, M., Kottenberg, E., Frey, U., **Neuhäuser, M.** et al. (2017): No protection of heart, kidneys and brain by remote ischemic preconditioning before transfemoral transcatheter aortic valve implantation: Interim-analysis of a randomized single-blinded, placebo-controlled, single-center trial. *International Journal of Cardiology* 231, 248-254.

26. Kleinbongard, P., **Neuhäuser, M.**, Thielmann, M., Kottenberg, E., Peters, J., Jakob, H. & Heusch, G. (2016): Confounders of cardioprotection by remote ischemic preconditioning in patients undergoing coronary artery bypass grafting. *Cardiology* 133, 128-133.

27. Hildebrandt, H.A., Patsalis, P.C., Al-Rashid, F., **Neuhäuser, M.**, Rassaf, T., Heusch, G., Kahlert, P. & Kleinbongard P. (2016): Quantification and characterisation of released plaque material during bioresorbable vascular scaffold implantation into right coronary artery lesions by multimodality intracoronary imaging. *EuroIntervention* 12, 1481-1489.

28. **Neuhäuser**, M. (2015): Combining the t test and Wilcoxon's rank sum test. *Journal of Applied Statistics* 42, 2769-2775.

29. Eder, H., Fiedler, W. & **Neuhäuser, M.** (2015): Evaluation of aerodynamic parameters from infrared laser tracking of free-gliding white storks. *Journal of Ornithology* 156, 667-677.

30. Gent, S., Kleinbongard, P., Dammann, P., **Neuhäuser, M.** & Heusch, G. (2015): Heart rate reduction and longevity in mice. *Basic Research in Cardiology* 110:2.

31. Michel, C., Woods, A.T., **Neuhäuser, M.**, Landgraf, A. & Spence, C. (2015): Rotating plates: Online study demonstrates the importance or orientation in the plating of food. *Food Quality and Preference* 44, 194-202.

32. Puth, M.-T., **Neuhäuser, M.** & Ruxton, G.D. (2015): Effective use of Spearman's and Kendall's correlation coefficients for association between two measured traits. *Animal Behaviour* 102, 77-84.

33. Puth, M.-T., **Neuhäuser, M.** & Ruxton, G.D. (2015): On the variety of methods for calculating confidence intervals by bootstrapping. *Journal of Animal Ecology* 84, 892-897.

34. Ruxton, G.D., Wilkinson, D.M. & **Neuhäuser, M.** (2015): Advice on testing the null hypothesis that a sample is drawn from a normal distribution. *Animal Behaviour* 107, 249-252.

35. Wendt, D., Al-Rashid, F., Kahlert, P., El-Chilali, K., Demircioglu, E., **Neuhäuser, M.**, Liakopoulos, O., Dohle, D.S., Erbel. R., Jakob, H. &

Thielmann, M. (2015): Conventional aortic valve replacement or transcatheter aortic valve implantation in patients with previous cardiac surgery. *Journal of Cardiology* 66, 292-297.

36. Wendt, D., Kleinbongard, P., Knipp, S., Al-Rashid, F., Gedik, N., El Chilali, K., Schweter, S., Schlamann, M., Kahlert, P., **Neuhäuser, M.**, Forsting, M., Erbel, R., Heusch. G., Jakob, H. & Thielmann M. (2015): Intraaortic protection from embolization in patients undergoing transaortic transcatheter aortic valve implantation. *Annals of Thoracic Surgery* 100, 686-691.

37. Leuchs, A.-K., Zinserling, J., Schlosser-Weber, G., Berres, M., **Neuhäuser, M.** & Benda, N. (2014): Estimation of the treatment effect in the presence of non-compliance and missing data. *Statistics in Medicine* 33, 193-208.

38. Puth, M.-T., **Neuhäuser, M.** & Ruxton, G.D. (2014): Effective use of Pearson's product-moment correlation coefficient. *Animal Behaviour* 93, 183-189.

39. Wendt, D., Thielmann, M., Plicht, B., Aßmann, J., Price, V., **Neuhäuser, M.** & Jakob, H. (2014): The new St Jude Trifecta versus Carpentier-Edwards Perimount Magna and Magna Ease aortic bioprosthesis: is there a hemodynamic superiority? *Journal of Thoracic and Cardiovascular Surgery* 147, 1553-1560.

40. Thielmann, M., Kottenberg, E., Kleinbongard, P., Wendt, D., Gedik, N., Pasa, S., Price, V., Tsagakis, K., **Neuhäuser, M.**, Peters, J., Jakob, H. & Heusch G. (2013): Cardioprotective and prognostic effects of remote ischaemic preconditioning in patients undergoing coronary artery bypass surgery: a single-centre randomised, double-blind, controlled trial. *Lancet* 382, 597-604. (Erratum in *Lancet* 382, 940).

41. Leuchs, A.-K. & **Neuhäuser, M.** (2013): A modified combination test for the analysis of a clinical trial when a protocol amendment changed the inclusion criteria. *Journal of Statistical Computation and Simulation* 83, 823-834.

42. Ruxton, G.D. & **Neuhäuser, M.** (2013): Improving the reporting of p-values generated by randomization methods. *Methods in Ecology and Evolution* 4, 1033-1036.

43. Ruxton, G.D. & **Neuhäuser, M.** (2013): Review of alternative approaches to calculation of a confidence interval for the odds ratio of a 2x2 contingency table. *Methods in Ecology and Evolution* 4, 9-13.

44. Neuhäuser, A., Mischler, M., Ruxton, G.D. & **Neuhäuser, M.** (2013): Gründe für von der Fraktionsdisziplin abweichendes Abstimmungsverhalten bei Bundestagsabgeordneten. *AStA Wirtschafts- und Sozialstatistisches Archiv* 7, 91-99.

45. Wendt, D., Kahlert, P., Lenze, T., **Neuhäuser, M.**, Price, V., Konorza, T., Erbel, R., Jakob, H. & Thielmann M. (2013): Management of high-risk patients with aortic stenosis and coronary artery disease. *Annals of Thoracic Surgery* 95, 599-605.

46. Thielmann, M., Pasa, S., Wendt, D., Price, V., Marggraf, G., **Neuhäuser, M.**, Piotrowski, A. & Jakob H. (2012): Prognostic significance of cardiac troponin

I on admission for surgical treatment of acute pulmonary embolism: a single-centre experience over more than 10 years. *European Journal of Cardio-thoracic Surgery* 42, 951-957.

47. **Neuhäuser, M.**, Leuchs, A.-K. & Ball, D. (2011): A new location-scale test based on a combination of the ideas of Levene and Lepage. *Biometrical Journal* 53, 525-534.

48. **Neuhäuser, M.** (2010): A nonparametric two-sample comparison for skewed data with unequal variances. *Journal of Clinical Epidemiology* 63, 691-693.

49. **Neuhäuser, M.** (2010): An equivalence test based on *n* and *p*. *Journal of Modern Applied Statistical Methods* 9, 304-307.

50. **Neuhäuser, M.**, Kotzmann, J., Walier, M. & Poulin, R. (2010): The comparison of mean crowding between two groups. *Journal of Parasitology* 96, 477-481.

51. Ruxton, G.D., Rey, D. & **Neuhäuser, M.** (2010): Comparing samples with large numbers of zeros. *Animal Behaviour* 80, 937-940.

52. Ruxton, G.D. & **Neuhäuser, M.** (2010): When should we use one-tailed hypothesis testing? *Methods in Ecology and Evolution* 1, 114-117.

53. Leuchs, A.-K. & **Neuhäuser, M.** (2010): A SAS/IML algorithm for exact nonparametric paired tests. *GMS Medizinische Informatik, Biometrie und Epidemilogie* 6, doc 04.

54. Thielmann, M., Kottenberg, E., Boengler, K., Raffelsieper, C., **Neuhäuser, M.**, Peters, J., Jakob, H. & Heusch, G. (2010): Remote ischemic preconditionning reduces myocardial injury after coronary artery bypass surgery with crystalloid cardioplegic arrest. *Basic Research in Cardiology* 105, 657–664.

55. Thielmann, M., Mechmet, A., **Neuhäuser, M.**, Wendt, D., Tossios, P., Canbay, A., Masoudy, P. & Jakob, H. (2010): Risk prediction and outcomes in patients with liver cirrhosis undergoing open-heart surgery. *European Journal of Cardio-thoracic Surgery* 38, 592-599.

56. **Neuhäuser, M.** (2009): A maximum test for the analysis of ordered categorical data. *Journal of Modern Applied Statistical Methods* 8, 592-593.

57. **Neuhäuser, M.** (2009): The importance of the biological system underlying the data when choosing a statistical test. *Animal Behaviour* 77, e1-e3.

58. **Neuhäuser, M.** & Ruxton, G.D. (2009): Distribution-free two-sample comparisons in the case of heterogeneous variances. *Behavioral Ecology and Sociobiology* 63, 617-623.

59. **Neuhäuser, M.** & Ruxton, G.D. (2009): Round your numbers in rank tests: exact and asymptotic inference and ties. *Behavioral Ecology and Sociobiology* 64, 297-303.

60. **Neuhäuser, M.** & Senske, R. (2009): The analysis of multicenter clinical trials when there is heterogeneity between centers. *Journal of Statistical Computation and Simulation* 79, 1381-1387.

61. **Neuhäuser, M.**, Schulz, A. & Czech, D. (2009): A SAS/IML algorithm for an exact permutation test. *GMS Medizinische Informatik, Biometrie und Epidemilogie* 5, doc 13.

62. Wendt, D., Buck, T. Janosi, R.A., Thielmann, M., Pul, U., **Neuhäuser, M.**, Piotrowski, J.A., Masoudy, P., Kamler, M., Erbel, R. & Jakob, H. (2009): Results of a propensity score-matched comparison of the Perimount Magna and Mosaic Ultra aortic valve prostheses. *Journal of Heart Valve Disease* 18, 703-711.

63. Massoudy, P., Thielmann, M, Lehmann, N., Marr, A., Kleikamp, G., Maleszka, A., Zittermann, A., Körfer, R., Radu, M., Krian, A., Litmathe, J., Gams, E., Sezer, Ö., Scheld, H., Schiller, W., Welz, A., Dohmen, G., Autschbach, R., Slottosch, I., Wahlers, T., **Neuhäuser, M.**, Jöckel, K.-H. & Jakob, H. (2009): Impact of prior percutaneous coronary intervention on the outcome of coronary artery bypass surgery: A multi-center analysis. *Journal of Thoracic and Cardiovascular Surgery* 137, 840-845.

64. Sotiropoulos, G.C., Bockhorn, M., Sgourakis, G., Brokalaki, E., Molmenti, E.P., **Neuhäuser, M.**, Radtke, A., Wohlschläger, J., Baba, H.A., Brölsch, C.E. & Lang, H. (2009): R0 liver resections for primary malignant liver tumors in the noncirrhotic liver: a diagnosis-related analysis. *Digestive Diseases and Sciences* 54, 887-894.

65. Nonnemacher, M., Stausberg, J., Bartoszek, G., Lottko, B., **Neuhäuser, M.** & Meier, I. (2009): Predicting pressure ulcer risk: a multifactorial approach to assess risk factors in a large university hospital population. *Journal of Clinical Nursing* 18, 99-107.

66. Johnson, L.S., Thompson, C.F., Sakaluk, S.K., **Neuhäuser, M.**, Johnson, B.G.P., Sonkup, S.S., Forsythe, S.J. & Masters, B.S. (2009): Extra-pair young in house wren broods are more likely to be male than female. *Proceedings of the Royal Society London B* 276, 2285-2289.

67. Kühnast, C. & **Neuhäuser, M.** (2008): A note on the use of the nonparametric Wilcoxon-Mann-Whitney test in the analysis of medical studies. *GMS German Medical Science* 6, Doc02.

68. Kröger K., Weiland, D., Wagener, T. & **Neuhäuser, M.** (2008): Immobility of patients in medical and orthopaedic departments: A German-wide survey. *Thrombosis Research* 123, 251-257.

69. Lösch, C. & **Neuhäuser, M.** (2008): The statistical analysis of a clinical trial when a protocol amendment changed the inclusion criteria. *BMC Medical Research Methodology* 8, 16.

70. Sgourakis, G., Sotiropoulos, G.C., **Neuhäuser, M.**, Musholt, T.J., Karaliotas, C. & Lang, H. (2008): Comparison between minimally invasive video-assisted thyroidectomy and conventional thyroidectomy: is there any evidence-based information? *Thyroid* 18, 721-727.

71. Krackow, S. & **Neuhäuser, M.** (2008): Insights from complete-incomplete brood sex ratio disparity. *Behavioral Ecology and Sociobiology* 62, 469-477.

72. Gana Dresen, I.M., Boes, T., Hüsing, J., **Neuhäuser, M.** & Jöckel, K.-H. (2008): New resampling method for evaluating stability of clusters. *BMC Bioinformatics* 9, 42.

73. **Neuhäuser, M.** (2007): A comparative study of nonparametric two-sample tests after Levene's transformation. *Journal of Statistical Computation and Simulation* 77, 517-526.

74. **Neuhäuser, M.**, Boes, T. & Jöckel, K.-H. (2007): Pseudo-precision in gene expression values can reduce efficiency. *Methods of Information in Medicine* 46, 538-541.

75. **Neuhäuser, M.** & Cuming, P. (2007): Climate change and the arrival of self-introduced bird species in New Zealand. *Notornis* 54, 11-14.

76. **Neuhäuser, M.** & Krackow, S. (2007): Adaptive-filtering of trisomy 21: Risk of Down syndrome depends on family size and age of previous child. *Naturwissenschaften* 94, 117-121.

77. **Neuhäuser, M.**, Lösch, C. & Jöckel, K.-H. (2007): The Chen-Luo test in case of heteroscedasticity. *Computational Statistics and Data Analysis* 51, 5055-5060.

78. Nonnemacher, M., Weiland, D., **Neuhäuser, M.** & Stausberg, J. (2007): Adaptive management of data quality in cohort studies and registers: proposal for a guideline. *Acta Informatica Medica* 15, 225-230.

79. Schoch, B., Regel, J.P., Frings, M., Gerwig, M., Maschke, M., **Neuhäuser, M.** & Timmann, D. (2007): Reliability and validity of ICARS in focal cerebellar lesions. *Movement Disorders* 22, 2162-2169.

80. Sotiropoulos, G.C., Lang, H., Nadalin, S., **Neuhäuser, M.**, Molmenti, E.P., Baba, H.A., Paul, A., Saner, F.H., Weber, F., Hilgard, P., Frilling, A., Broelsch, C.E. & Malagó, M. (2007): Liver transplantation for hepatocellular carcinoma: University Hospital Essen experience and metaanalysis of prognostic factors. *Journal of the American College of Surgeons* 205, 661-675.

81. Sotiropoulos, G.C., Malagó, M., Molmenti, E.P., Lösch, C., Lang, H., Frilling, A., Broelsch, C.E. & **Neuhäuser, M.** (2007): Hilar lymph nodes sampling at the time of liver transplantation for hepatocellular carcinoma: to do or not to do? Meta-analysis to determine the impact of hilar lymph nodes metastases on tumor recurrence and survival. *Transplant International* 20, 141-146.

82. Thielmann, M., **Neuhäuser, M.**, Knipp, S., Kottenberg-Assenmacher, E., Marr, A., Pizamis, H., Hartmann, M., Kamler, M., Massoudy, P. & Jakob, H. (2007): Prognostic impact of previous percutaneous coronary intervention in patients with diabetes mellitus and triple-vessel disease undergoing coronary artery bypass surgery. *Journal of Thoracic and Cardiovascular Surgery* 134, 470-476.

83. Thielmann, M., **Neuhäuser, M.**, Marr, A., Herold, U., Kamler, M., Massoudy, P. & Jakob, H. (2007): Predictors and outcomes of coronary artery bypass grafting in ST elevation myocardial infarction. *Annals of Thoracic Surgery* 84, 17-24.

84. Thielmann, M., **Neuhäuser, M.**, Marr, A., Jaeger, B.R., Wendt, D., Schuetze, B., Kamler, M., Massoudy, P., Erbel, R. & Jakob, H. (2007): Lipid-lowering effect of preoperative statin therapy on postoperative major adverse cardiac events after coronary artery bypass surgery. *Journal of Thoracic and Cardiovascular Surgery* 134, 1143-1149.

85. **Neuhäuser, M.** (2006): An exact test for trend among binomial proportions based on a modified Baumgartner-Weiß-Schindler statistic. *Journal of Applied Statistics* 33, 79-88.

86. **Neuhäuser, M.** & Hothorn, L.A. (2006): Maximum tests are adaptive permutation tests. *Journal of Modern Applied Statistical Methods* 5, 317-322.

87. **Neuhäuser, M.** & Hothorn, L.A. (2006): A robust modification of the ordered-heterogeneity test. *Journal of Applied Statistics* 33, 721-727.

88. **Neuhäuser, M.** & Jöckel, K.-H. (2006): A bootstrap test for the analysis of microarray experiments with a very small number of replications. *Applied Bioinformatics* 5, 173-179.

89. **Neuhäuser, M.** & Jöckel, K.-H. (2006): Methacholine challenge tests: Sample sizes required in crossover trials. *International Journal of Clinical Pharmacology and Therapeutics* 44, 27-30.

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