

An overview and categorization of papers about statistical issues published in series of medical journals (working title)

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We will invite: Members of the TG2 paper, Members of SG, Experienced adjunct members ,
Strongly interested STRATOS members are welcome

<http://stratos-initiative.org/>

TG2 papers about regression modeling

Systematic review of education and practical guidance on regression modeling for medical researchers who lack a strong statistical background: Study protocol

Paul Bach^{1,2,3}, Christine Wallisch^{1,2,4}, Nadja Klein³, Lorena Hafermann^{1,2}, Willi Sauerbrei⁵, Ewout W. Steyerberg⁶, Georg Heinze⁴, Geraldine Rauch^{1,2*}, for topic group 2 of the STRATOS initiative[¶]

Review of guidance papers on regression modeling in statistical series of medical journals

Christine Wallisch^{1,2*}, Paul Bach^{1,3}, Lorena Hafermann¹, Nadja Klein³, Willi Sauerbrei⁴, Ewout W. Steyerberg⁵, Georg Heinze², Geraldine Rauch^{1*}, on behalf of topic group 2 of the STRATOS initiative[¶]

Table 1: List of candidate series for potential inclusion in the review from Wallisch et al. (2022).

Some journals added. Relevant journals missed?

ID	Journal	Title of the series	Reason for exclusion / # of articles and year of most recent article
1	Advances in Physiology Education	Explorations in statistics column	13; 2018
2	American Journal of Epidemiology	Practice of Epidemiology Issue Section	too advanced, >1000 articles
3	Annals of Allergy, Asthma & Immunology	The reading, writing, and arithmetic of the medical literature	less than 5 coherent articles
4	Archives of Disease in Childhood	Statistics from the inside series	16(17); 1995
5	Circulation	Statistical Primer for Cardiovascular Research	23; 2009
6	Clinical Radiology	A guide to clinical epidemiology for radiologists: Part I and II	less than 5 coherent articles
7	Columbia University	Population Health Methods	not published in a medical journal
8	Deutsche Medizinische Wochenzeitschrift	Statistik-Serie in der DMW	not published in English
9	Deutsche Zahnärztliche Zeitschrift	EbM-Splitter	not published in English
10	Deutsches Ärzteblatt	Serie zur Bewertung wissenschaftlicher Publikationen	not published in English
11	Deutsches Ärzteblatt International*	Series on Evaluation of Scientific Publications	24(31); 2023
12	Emergency Medicine Journal	An introduction to statistics	no topic-relevant article
13	European Heart Journal	Statistical Tutorials	5; 2014

Table 2: Categories

1. Adjustment for variables
2. Bayesian statistics
3. Bias
4. Causal inference
5. Confounding
6. Continuous variables
7. Diagnostic studies
8. General statistical issues
9. High-dimensional data
10. Machine learning
11. Measurement error
12. Meta-analysis
13. Missing data
14. Models
 1. Model building
 2. Sensitivity analyses/Check of model assumptions
15. Multiple testing
16. Non-parametric methods
17. Observational studies
18. Prediction models
19. Randomized trials
 1. Design
 2. Subgroups/treatment heterogeneity
 3. Other topics
20. Regression model
 1. Linear regression
 2. Logistic regression
 3. Cox regression
 4. More complex models
21. Repeated measurements/Longitudinal data
22. Resampling
23. Risk/risk communication
24. Sample size
25. Screening
26. Simulation
27. Statistical inference
28. Statistical tests
29. Study design
30. Survival analysis
31. Tree-based approaches
32. Validation
33. Visualization

Appendix 2 – Short summaries of categories (by ChatGPT)

I asked ChatGPT “Having a medical background in mind, give a brief overview (up to 250 words) of *topic*”

Adjustment for variables

Adjustment for variables in medical research refers to the process of controlling for confounding factors to isolate the true effect of the primary independent variable on the outcome of interest. Confounding variables are extraneous factors that are associated with both the exposure and the outcome, potentially biasing the results if not accounted for.

Key aspects of adjustment for variables include:

- 1. Identification of Confounders:** Confounders are variables that can distort the observed relationship between the exposure and outcome. Identifying potential confounders involves understanding the study context, previous research, and causal pathways.
- 2. Statistical Methods for Adjustment:** Various statistical techniques are used to adjust for confounding variables:
 - **Multivariable Regression:** Including confounders as covariates in regression models (e.g., linear regression, logistic regression) helps control for their effects and estimate the adjusted association between the primary independent variable and the outcome.
 - **Propensity Score Methods:** Propensity scores estimate the probability of treatment assignment based on confounders. Methods such as matching, stratification, and weighting using propensity scores can balance confounders between treatment groups.
 - **Stratification:** Analyzing the data within strata of the confounding variable (e.g., age groups, gender) allows for comparison of exposure effects within homogeneous subgroups.
 - **Instrumental Variables:** Instruments are variables that are correlated with the exposure but not directly with the outcome, allowing for adjustment of unmeasured confounding.
- 3. Importance of Proper Adjustment:** Proper adjustment for confounders is critical for reducing bias and improving the validity of study findings. It ensures that the observed associations are more likely to reflect causal relationships rather than spurious correlations due to confounding. Adjusting for variables enhances the credibility and reliability of medical research findings, supporting evidence-based clinical decision-making and policy development. By carefully identifying and controlling for confounders, researchers can draw more accurate and meaningful conclusions about the relationships between exposures and health outcomes.

Continuation: I asked ChatGPT “Having a medical background in mind, give a brief overview (up to 250 words) of *topic*”

Bayesian statistics

Bayesian statistics is a branch of statistical analysis that provides a framework for updating probabilities based on new evidence or information. In medicine, Bayesian methods are increasingly used for various purposes, including clinical decision-making, epidemiological research, and predictive modeling.

Key concepts in Bayesian statistics include:

- 1. Prior Probability:** Before observing any data, Bayesian analysis starts with a prior probability distribution representing existing knowledge or beliefs about the parameters of interest.
- 2. Likelihood Function:** This function describes the probability of observing the data given different values of the parameters in the model.
- 3. Posterior Probability:** Using Bayes' theorem, the prior probability distribution is updated based on the observed data to obtain the posterior probability distribution. The posterior distribution represents updated beliefs about the parameters after considering the new evidence.
- 4. Bayesian Inference:** Bayesian inference involves calculating the posterior probability distribution to make statistical inferences about the parameters of interest. This approach provides a formal mechanism for incorporating prior knowledge and updating beliefs in light of new data.
- 5. Markov Chain Monte Carlo (MCMC) Methods:** Bayesian analysis often involves complex models with high-dimensional parameter spaces. MCMC methods, such as Gibbs sampling and Metropolis-Hastings algorithms, are used to generate samples from the posterior distribution when analytical solutions are not feasible.
- 6. Decision Analysis:** Bayesian statistics facilitates decision-making by incorporating uncertainty and variability into decision models. It allows for the calculation of posterior probabilities of different outcomes and the selection of optimal decisions based on utility functions.

In summary, Bayesian statistics offers a flexible and powerful framework for statistical inference, particularly in situations with limited data or prior knowledge. Its application in medicine enables clinicians and researchers to make informed decisions, incorporate uncertainty, and update beliefs based on evolving evidence.

Continuation: I asked ChatGPT “Having a medical background in mind, give a brief overview (up to 250 words) of *topic*”

Bias

In medicine, bias refers to systematic errors or distortions that can affect the validity, reliability, and generalizability of research findings or clinical decisions. Bias can arise at various stages of the research process and clinical practice, influencing study design, data collection, analysis, interpretation, and decision-making.

Key types of bias in medicine include:

- 1. Selection Bias:** Arises when there are systematic differences between the characteristics of individuals included in a study and those who are excluded, leading to biased estimates of associations.
- 2. Information Bias:** Occurs when there are errors in the measurement or classification of variables, such as misclassification of exposure or outcome, leading to inaccurate estimation of associations.
- 3. Confounding Bias:** Arises when an extraneous factor is associated with both the exposure and outcome, leading to a spurious association. Controlling for confounders through study design or statistical analysis is essential to minimize this bias.
- 4. Publication Bias:** Occurs when studies with statistically significant results are more likely to be published than those with null or non-significant findings, leading to an overestimation of treatment effects.
- 5. Recall Bias:** Arises when there are differences in the accuracy or completeness of recall of past events or exposures between study groups, leading to biased estimates of associations.
- 6. Performance Bias:** Occurs when there are systematic differences in the care provided to participants in different study groups, leading to biased estimates of treatment effects in clinical trials.

Identifying, minimizing, and addressing bias are critical in medical research and clinical practice to ensure that study findings are valid, reliable, and applicable to the target population. Various strategies, such as randomization, blinding, standardized data collection methods, and sensitivity analyses, are employed to mitigate bias and strengthen the validity of research findings.

Appendix 2 Table A1:

Papers sorted into categories (the principle, to be updated)

Category	Articles
1. Adjustment for variables	Dtsch Arztebl Int22-Tönnies; JAMA22a-Holmberg; JAMA22b-Holmberg; JAMA16-Kyriacou; JAMA23-Marion; JAMA20-Thomas; JAMA15-Haukoos; JAMA19- Maciejewski; JAMA19-Norton; J Thorac Dis17-Chen, JAMA14-Cao; Stat Med20-Proschan
2. Bayesian statistics	
3. Bias	
4. Causal inference	Dtsch Arztebl Int11-Kabisch; Dtsch Arztebl Int22-Tönnies; Dtsch Arztebl Int23-Tönnies; JAMA22-Lipsky; JAMA22b-Holmberg; JAMA19-Lee; JAMA17-Emdin
5. Confounding	
6. Continuous variables	
7. Diagnostic studies	Dtsch Arzteblt Int21-Hoyer; Stat Med22-Arifin
8. General statistical issues	DtschArztebltInt09-Bautsch; DtschArztebltInt09-Hammer; DtschArztebltInt09-Sauerbrei; DtschArztebltInt21-Pohl; JAMA2017-Irony; JAMA23-Saville; JAMA19-Sanders; JAMA15-Fitzgerald; JAMA21-Little; JAMA18-Carin; JAMA18-Norton; JAMA22-Weinfurt; JAMA14-Lim; JThoracDis16-Thiese; JThoracDis16-Liu; JThoracDis14-Brunelli; JThoracDis15-Bertolaccini; StatMed23-Ocampo; StatMed22-Stensrud; StatMed20-Keogh; StatMed20-Shaw; StatMed19-Infanger
9. High-dimensional data	JAMA19-Guo; JThoracDis15-Pasini; StatMed22-Zhan; StatMed22-Shutta
10. Machine learning	

Appendix 2

Table A2: Basic information about papers

Title	Abstract (y/n)	# Pages	# Refs	# Tables/Graphics	Notes
DtschArzteblInt09-Bautsch	Y	3	6	3	
DtschArzteblInt09-Hammer	Y	4	21	3	
DtschArzteblInt10-duPrel	Y	5	14	3	
DtschArzteblInt11-Kabisch	Y	5	24	4	
DtschArzteblInt11-Zwiener	Y	6	13	5	
DtschArzteblInt21-Hoyer	Y	5	14	6	
DtschArzteblInt09a-Röhrig	Y	6	25	4	
DtschArzteblInt09b-Röhrig	Y	5	25	4	
DtschArzteblInt09-Ressing	Y	6	25	6	
DtschArzteblInt09-Sauerbrei	Y	5	14	7	
DtschArzteblInt10-Röhrig	Y	4	17	3	
DtschArzteblInt10-Schneider	Y	6	8	9	
DtschArzteblInt12-Spix	Y	4	25	3	
DtschArzteblInt12-Weinfurt	Y	5	18	7	
DtschArzteblInt12-Wellek	Y	5	23	5	
DtschArzteblInt21-Pohl	Y	5	28	3	
DtschArzteblInt22-Tönnies	Y	5	13	3	
DtschArzteblInt23-Tönnies	Y	6	16	5	
JAMA14-Cao	N	2	6	1	
JAMA14-Stokes	N	2	4	1	
JAMA15-Fitzgerald	N	2	5	1	
JAMA15-Haukoos	N	2	7	-	

Appendix 3 – List of all papers

Some of the papers are not about statistical topics, some article to delete? See e.g. series 24-26

1. Advances in Physiology Education: Explorations in statistics

1. Curran-Everett D. (2008). Explorations in statistics: standard deviations and standard errors. *Advances in physiology education*, 32(3), 203–208. <https://doi.org/10.1152/advan.90123.2008>
2. Curran-Everett D. (2009). Explorations in statistics: confidence intervals. *Advances in physiology education*, 33(2), 87–90. <https://doi.org/10.1152/advan.00006.2009>
3. Curran-Everett D. (2009). Explorations in statistics: hypothesis tests and P values. *Advances in physiology education*, 33(2), 81–86. <https://doi.org/10.1152/advan.90218.2008>
4. Curran-Everett D. (2009). Explorations in statistics: the bootstrap. *Advances in physiology education*, 33(4), 286–292. <https://doi.org/10.1152/advan.00062.2009>

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13. Curran-Everett, D., & Williams, C. L. (2015). Explorations in statistics: the analysis of change. *Advances in physiology education*, 39(2), 49–54. <https://doi.org/10.1152/advan.00018.2015>

4. Archives of disease in childhood: statistics from the inside

1. Healy M. J. (1991). Populations and samples. *Archives of disease in childhood*, 66(11), 1355–1356. <https://doi.org/10.1136/adc.66.11.1355>
2. Healy M. J. (1991). Statistics from the inside. 2. Significance tests. *Archives of disease in childhood*, 66(12), 1457–1458. <https://doi.org/10.1136/adc.66.12.1457>
3. Healy M. J. (1992). Statistics from the inside. 3. Estimation. *Archives of disease in childhood*, 67(1), 149–150. <https://doi.org/10.1136/adc.67.1.149>

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Working Plan

The paper will be written on behalf of the STRATOS initiative. Members will be named in the appendix.

To do for Co-authors:

- Further series known?
- Modify categorization?
- Check ChatGPT summary. About 8 terms to check
- Classify papers. About 100 papers

Willi, Edwin, Milena will create a new version of the ChatGPT description. We will send them to the reviewers (3 reviewers per text)

Willi and Milena will send papers to categorize.

Future: try to fill relevant gaps. Based on this work several papers can follow (e.g. more special papers for TG issues).