

Practices, Perceptions, and Patterns of Research Integrity (PRINT)

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Main research objectives of PRINT

1. To examine, define and typologize Questionable Research Practices (QRPs)
2. To estimate their prevalence and examine perceptions of them within and across main fields of research (knowledge production models)
3. To elucidate the most predominant mechanisms potentially influencing QRPs, and examine how they relate to individuals, institutions, norms, and standards
4. To provide a contextualized mapping of the current integrity of Danish research
5. On the basis of the findings, to provide recommendations for improving research integrity in Denmark and beyond

Responsible conduct of research

Responsible conduct of research

- good research practice with integrity

Research misconduct

- fraud



The practice of efficient production of relevant, valid, transparent, reliable and reproducible scientific knowledge

- Fabrication
- Falsification
- Plagiarism

A responsible researcher is conceptualized as: objective, meticulous, sceptical, rational, and not subject to external incentives such as prestige or social pressure

Misconduct is formally defined as three types of condemned behaviours: fabrication falsification, and plagiarism (FFP)

Responsible conduct of research

Responsible conduct of research (RCR)

- good research practice with integrity

Questionable Research Practices (QRP)

- the grey zone, a large zone of deviations from RCR that do not fall under the established definition of RM

Research misconduct (RM)

- fraud



'Ideal'

'Sloppy'

Unconscious bias

Conscious bias

- Fabrication
- Falsification
- Plagiarism

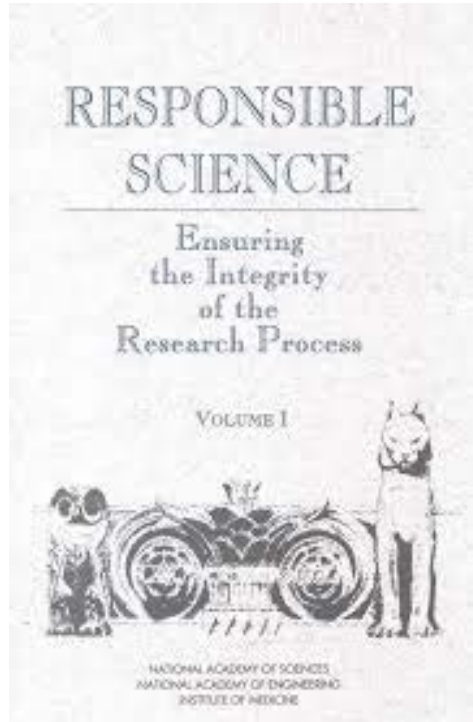
QRPs are highly contextual: disciplines, paradigms, traditions, geographic ...

QRPs are often unintentional, rooted in norms and traditions

Demarcation between QRP and RM is difficult to establish – there is no consensus

Conceptual issues

1992



Questionable
research
practices

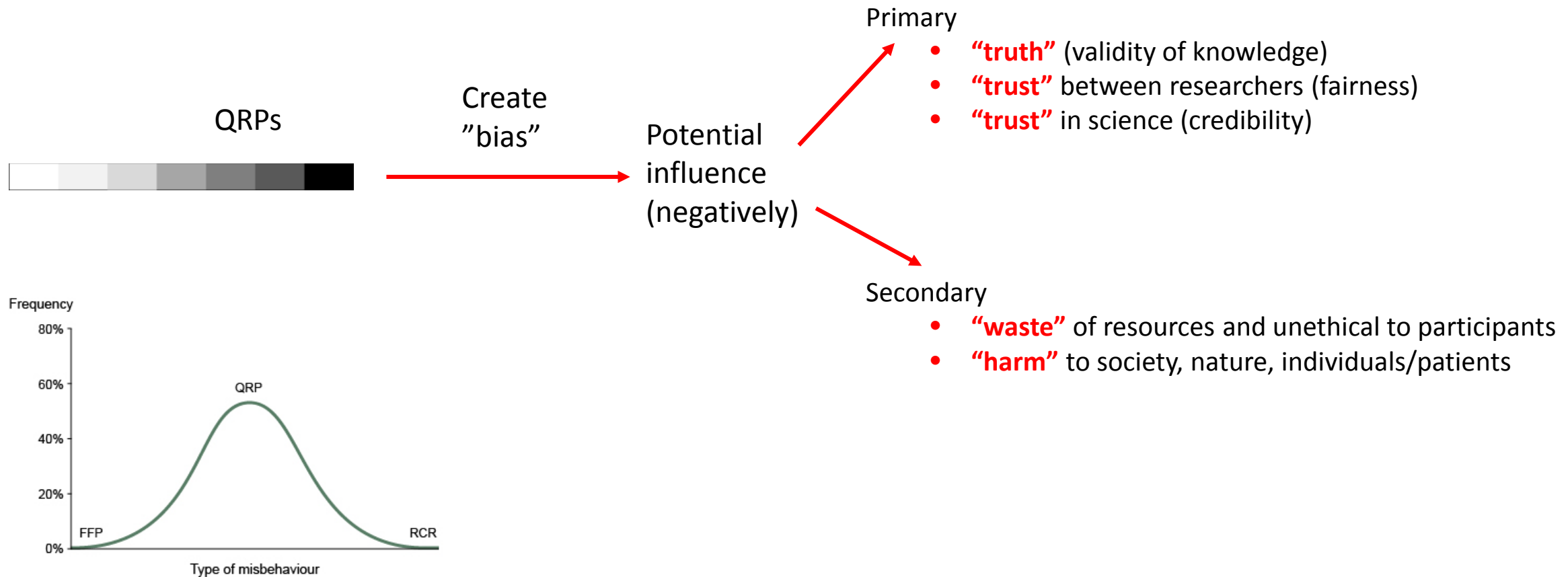
2017



Detrimental
research
practices



Conjecture: Breaches of research integrity can be harmful



What are they?

Bouter et al. *Research Integrity and Peer Review* (2016) 1:17
DOI 10.1186/s41073-016-0024-5

Research Integrity and
Peer Review

RESEARCH

Open Access



Ranking major and minor research misbehaviors: results from a survey among participants of four World Conferences on Research Integrity

Lex M. Bouter^{12*}, Joeri Tjeldink²³, Nils Axelsen⁴, Brian C. Martinson⁵ and Gerben ter Riet⁶

Abstract

Background: Codes of conduct mainly focus on research misconduct that takes the form of fabrication, falsification, and plagiarism. However, at the aggregate level, lesser forms of research misbehavior may be more important due to their much higher prevalence. Little is known about what the most frequent research misbehaviors are and what their impact is if they occur.

Methods: A survey was conducted among 1353 attendees of international research integrity conferences. They were asked to score 60 research misbehaviors according to their views on and perceptions of the frequency of occurrence, preventability, impact on truth (validity), and impact on trust between scientists on 5-point scales. We expressed the aggregate level impact as the product of frequency scores and truth, trust and preventability scores, respectively. We ranked misbehaviors based on mean scores. Additionally, relevant demographic and professional background information was collected from participants.

Results: Response was 17% of those who were sent the invitational email and 33% of those who opened it. The rankings suggest that selective reporting, selective citing, and flaws in quality assurance and mentoring are viewed as the major problems of modern research. The "deadly sins" of fabrication and falsification ranked highest on the impact on truth but low to moderate on aggregate level impact on truth, due to their low estimated frequency. Plagiarism is thought to be common but to have little impact on truth although it ranked high on aggregate level impact on trust.

Conclusions: We designed a comprehensive list of 60 major and minor research misbehaviors. Our respondents were much more concerned over sloppy science than about scientific fraud (FFP). In the fostering of responsible conduct of research, we recommend to develop interventions that actively discourage the high ranking misbehaviors from our study.

Keywords: Research integrity, Responsible conduct of research, Questionable research practices, Sloppy science, Research misconduct, Fabrication, Falsification, Plagiarism

100+ examples of deviations from responsible conduct of research that threaten the relevance, validity and efficiency of research, the trust between scientists, and the trust in science

- **Study design** (items that concern the phase before the start of data collection)
- **Data collection** (items that concern the phase of data collection)
- **Data-analysis** (items that concern the phase of data-analysis)
- **Reporting** (items that concern reporting of results of the study)
- **Collaboration** (items that concern obligations towards colleagues and science as a whole)

Somewhat biased towards the medical fields

A. Study design (22 items)

- 1. Propose study objectives which are clearly superfluous or irrelevant (Are the problems worth pursuing, or only of slight interest? Will the expected results add any value/usefulness? (Has the literature been critically reviewed, or has the review been superficial or selective? Could the questions be resolved by a systematic review of the literature? Has the study been done many times before/ have the expected results been obtained before? Are others already doing this?)**
- 2. Insufficient attention to the equipment, skills and expertise essential to do the study**
- 3. Inappropriate study design: Insufficient attention to effect-to-bias ratio**
- 4. Inappropriate study design: Insufficient attention to statistical power problems**
- 5. Inappropriate study design: Insufficient attention to the “vibration of effects” caused by flexibility of definitions and methods for data analysis**
- 6. Conceal the significance of the need for replication of the study**
- 7. Ignore substantial risks of the expected findings for society or the environment**
- 8. Ignore substantial safety risks of the study for participants, workers or environment**
- 9. Do not pay appropriate attention to laws and regulations pertinent for the study**
- 10. Do not explore, or conceal conflicts of interests and commitments in grant applications**
- 11. Write no, or a clearly inadequate research protocol**
- 12. Hype a grant application**
- 13. Misleading grant application: Present false research data**
- 14. Misleading grant application: Present grossly imbalanced information**
- 15. Misleading grant application: Withhold essential details of methodology**
- 16. Misleading grant application: Conceal already obtained own results (e.g. pilot data)**
- 17. Misleading grant application: Present a superficial literature review**
- 18. Misleading grant application: Present an undisclosed selective literature review**
- 19. Misleading grant application: Present false information on participants’ education, merits and affiliations**
- 20. Don’t show the entire grant application to all named participants of the study**
- 21. Fail to obtain (written) accept from all named participants before submitting a grant application**
- 22. Make an inappropriate change of the study objectives, design or methodology in response to coercion from a funding source (“funding bias”)**

B. Data collection (9 items)

- 1. Store materials or data in an insufficient way**
- 2. Handle and record materials and data in an inadequate/insufficient way**
- 3. Keep inadequate notes of the research process**
- 4. Fabricate or falsify data**
- 5. Change research design or methodology during the study, e.g. due to coercion from a funding source (and don't report it)**
- 6. Collect more data than stated in the protocol to obtain statistical significance (and don't report it) ('Data Peeking')**
- 7. Stop data collection earlier than planned because the result already is statistically significant (unless predefined stopping rules are implemented appropriately)**
- 8. Don't attend to the quality of data provided by coworkers/coauthors, ignore basic principles of quality assurance**
- 9. Don't adhere to pertinent laws and regulations**

C. Data analysis (9)

1. Delete data *before* performing data analyses (and don't report the deletion)(falsification)
2. Modify data *before* performing data analyses (and don't report the modification)(falsification)
3. Delete data *after* performing initial data analyses (and don't report the deletion)(falsification)
4. Modify data *after* performing initial analyses (and don't report the modification)(falsification)
5. HARKing : Undisclosed Hypothesizing After Results are Known ('Data- driven hypotheses without disclosure'; 'post hoc analyses of data until an exciting result emerges'; 'metamorphosing ugly initial results into beautiful articles' ('the Chrysalis effect'))
6. Significance chasing ('P-hacking'; 'data-dredging'; 'snooping'; 'fishing'; 'double-dipping'; explorative subgroup analysis; report an incorrect downwardly rounded P-value; 'trying multiple things /torture the data until you get the desired result')
7. Analyze only selected data in the study (selective analysis within the study)
8. Conscious use of inappropriate methods
9. Undisclosed data-analyses not stated in the research protocol

D. Reporting (28 items)

1. Don't report all protocol-stipulated results (Selective Reporting)
2. Conceal results that contradict research you have published previously
3. Do not attempt to report a valid 'negative' study (Selective Reporting; the 'file drawer problem')
4. Report an unexpected finding as having been hypothesized from the start (HARKing)
5. Withhold clearly relevant details of study methods
6. Publish falsified or fabricated data, tables, curves or figures
7. Do not report replication problems
8. Cite the literature selectively to enhance own findings or convictions
9. Cite strategically in order to please editors, reviewers, or colleagues
10. Let conscious bias or prejudice influence the conclusions
11. Do not carefully study all the papers cited in the paper
12. Present an insufficient discussion of the study's flaws and limitations
13. Deliberately fail to mention important aspects of the study in the paper
14. Spread study results over more papers than needed, in order to increase own number of publications ('Salami slicing'/'Least Publishable Unit'–strategy)
15. Reuse your previously published data without disclosure
16. Reuse your previously used/published material without disclosure
17. Publish the same paper twice without disclosure (and permission from the editor(s))
18. Reuse parts your own previous publication without citation (self-plagiarism)
19. Use unpublished phrases, ideas or methods of others without their permission (plagiarism)
20. Use published phrases, ideas or methods of others without proper citation (plagiarism)
21. Modify the results or conclusions of a study in response to coercion from a sponsor who has seen the results (funding bias)
22. Do not disclose a sponsor of the study
23. Do not disclose relevant conflicts of interests and commitments
24. Report inaccurately that all authors meet the requirements for authorship. *For other authorship issues see below: E.14-28*
25. Do not correctly report where the research has been done
26. Communicate results to the public before peer review
27. Willfully communicate research findings inaccurately in public
28. Make no clear and explicit distinction between professional (expert) comments and personal views when engaging in public communication

E. Collaboration (40 items)

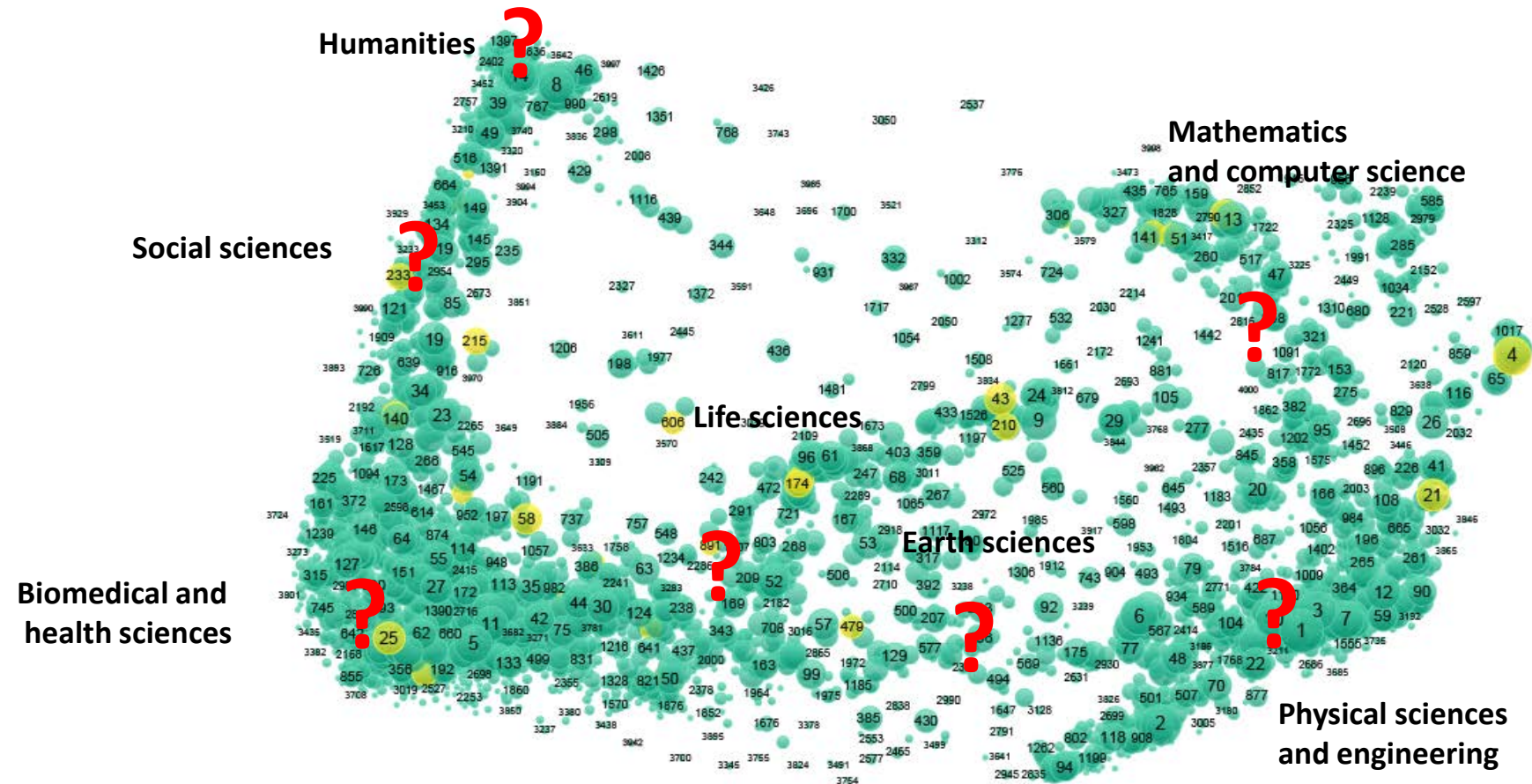
- 1. “Toxic leadership”: Obstruct critical, open minded and free discussion in your research group**
- 2. “Toxic leadership”: Let students unknowingly compete on solving the same problem**
- 3. “Toxic leadership”: Pay no attention to systematic fostering of RCR (ignore the fact that the most important RCR-training takes place in the daily life of research guided by an experienced supervisor/mentor)**
- 4. “Toxic leadership”: Assign too many PhD students to a project with “too little meat on the bone”**
- 5. “Toxic leadership”: Do not regularly have follow up meetings on how a collaborative research project evolves, e.g. concerning presentation of raw data, preliminary results, change of duties and authorship expectations**
- 6. Don’t take responsibility for the trustworthiness of the research in which you participate**
- 7. Do not as a senior/leading author accept the responsibility that is implicit in the definition of seniority/leadership for the trustworthiness of the research (blame others when something goes wrong in the group you lead)**
- 8. Turn a blind eye to other people’s putative breaches of research integrity**
- 9. Do not respond to suspicions of breaches of research integrity**
- 10. Do not pay respect to whistle blowers who in good faith report suspicions of RM, or breeches of RCR**
- 11. Do not respond to whistle blowers who in bad faith report suspicions RM**
- 12. Be unwilling to share data and materials with bona fide peers**
- 13. Supervise and mentor (junior) coworkers insufficiently**
- 14. Prevent from authorship a person who is qualified for authorship**
- 15. Omit from authorship a person who evidently is a major contributor (ghost authorship)**
- 16. Invite a person for an authorship for which she/he not qualify**
- 17. Add an author who does not qualify for authorship**
- 18. Add a star scientist as co-author, although he/she is not qualified for authorship**
- 19. Demand an authorship for which you don’t qualify**
- 20. Accept an authorship for which you don’t qualify**

E. Collaboration (cont.)

21. **Accept a coauthor's proposal for adding an author who is not qualified for authorship**
22. **Accept or demand (significant) favors (gifts, money or sex) in exchange for authorship, access to data or promotion of particular persons**
23. **Do not acknowledge contributors who do not qualify for authorship**
24. **Do not ask permission by contributors for the wording of the acknowledgement**
25. **Do not openly discuss with the group of authors who does, or does not qualify for authorship**
26. **Submit a paper for publication without consent from all authors**
27. **Do not share and discuss reviewers' and editor's comment with all authors**
28. **Submit a revised paper for publication without all authors' consent**
29. **Game the review process by suggesting friendly reviewers**
30. **Game the review process by reviewing your own papers ('Self peer review')**
31. **Change the manuscript in accordance with reviewers' comments if the suggestions evidently are wrong or biased**
32. **Unfair reviewing: Delay your review**
33. **Unfair reviewing: Delay publication by excessively critical comments, or demand unreasonable extra work by the authors**
34. **Unfair reviewing of grant applications**
35. **Unfair reviewing of persons, e.g. for positions/promotion**
36. **Unfair reviewing: Don't disclose your conflicts of interests and commitments when reviewing papers, grant applications or persons for promotion**
37. **Use confidential reviewer information (from reviewing papers, grants, persons) for own work/grant applications/papers**
38. **Participate in manipulation of a journal's impact factor by excessive citing of papers from the journal, e.g. by coercion from the editor**
39. **Game citation metrics by inappropriate citation of own or others papers**
40. **Establish or manage a predatory journal**

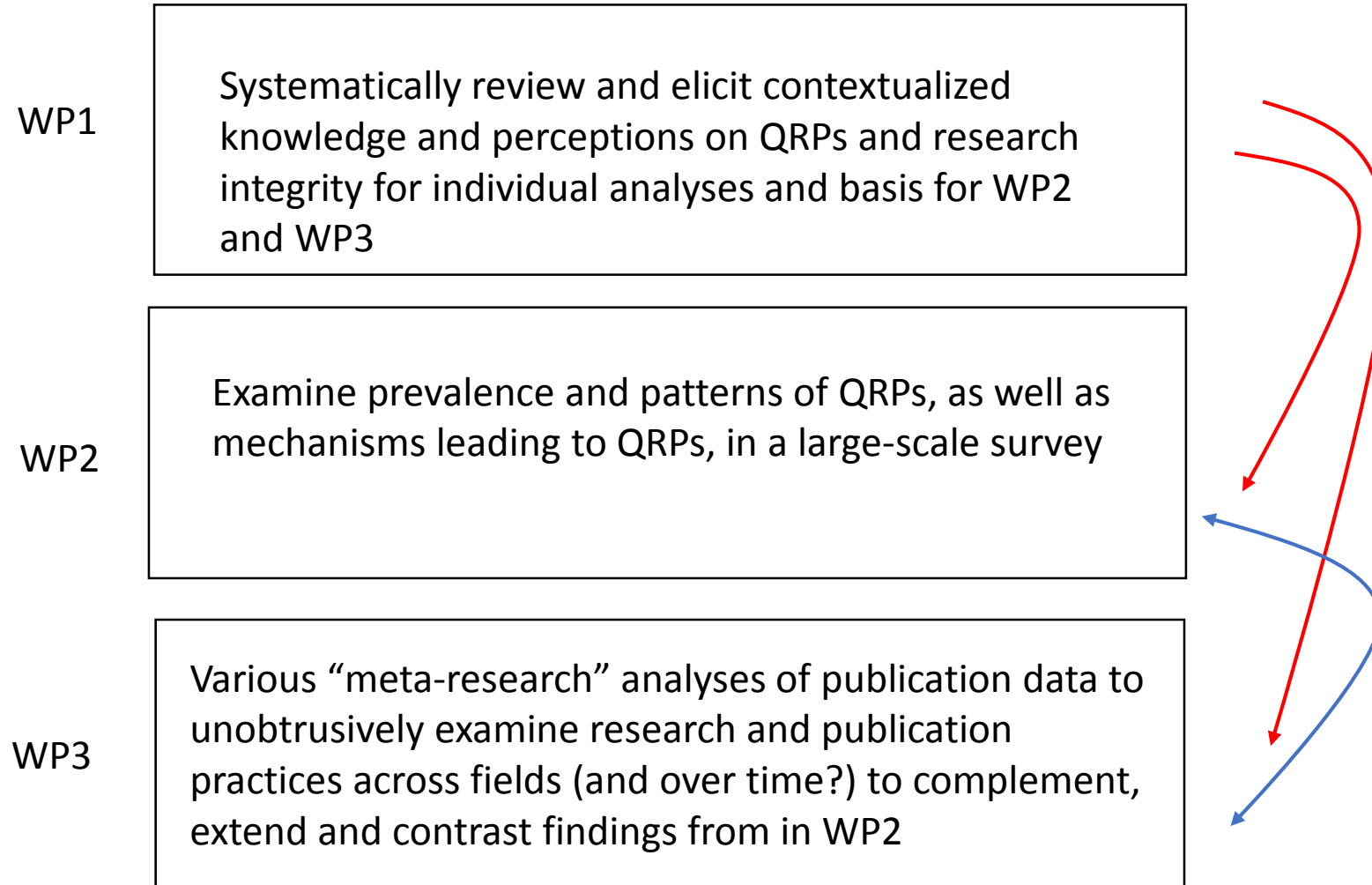
.....and still counting.....

Perceptions, relevance and prevalence



Perceptions and relevance of QRPs are varying extent conditional on "knowledge production models", norms and reward structures

The three work packages and their aims



WP 1

- Narrative and systematic reviews of the current literature and empirical claims
 - Manuscript is well-underway
- 22 focus group interviews (across all fields)
 - Input to survey (QRP formulations, “causes”)
 - “Thick descriptions”, qualitative analyses of various themes (e.g., QRPs in the humanities/natural sciences, perceived “causes ...)
- Typologizing QRPs
 - Analyses to be done at the end of the project

Interview themes

Introduction (10 min.)

1. The good research practice (10 min.)
2. Questionable research practices (10 min.)
3. Exercise: 8 pre-written cards with QRPs plus “free” cards must be graduated, first in relation to severity of the QRP, then in terms of prevalence. (15-20 min. for negotiation on severity, 10 min. break, 10 min. for negotiation of prevalence)
4. Reasons behind QRP (15 min.)
5. Generic questions (15 min.)

Rounding off (5 min)

Årlivrlighed

"Salami slicing"

Unfair tildeling af forfatterskaber

Mangelfuld datahåndtering og dataopbevaring

Selektiv citering

Manglende transparens ift. brug af metoder og data

Selektiv afrapportering af forskningsresultater

Unfair reviewing

Picking winners

"METER-VARJE-FORLYND" (DYNDST GET VJAGERKANT PAPERD)

(nu) Mange forfattere på artikler

Historisk mellem teori og empiri

Heavy piping data

Research open peer review

Alw

most absolute

Udbredelse

Manglende
transparens
ift. brug af
metoder og
data

Selektiv
afrapportering
af
forskningsresu-
tater

Ud
Historisk revision
købt og sælgt

(E)TER-VALE-GEVIND
(H)ISTORISK
(S)ELV

(H)ISTORISK
(S)ELV

Meget
udbredt

P-hacking
og/eller
HARKING

Forskernes egne poli-
tiske holdninger
styrer forskning

Cherry picking data

Selektiv
citering

Mangelfuld
datahåndtering
og
dataopbevaring

Unfair tildeling
af
forfatterkaber

"Salami slicing"

Unfair
reviewing

WP 2

- Survey (currently sampling)
 - Sampling: Eight Danish universities, ten foreign universities in four countries
 - Questionnaire, focus on "truth":
 - Knowledge production modes
 - Perceptions of knowledge claims
 - Nine statements of QRPs (prevalence and relevance)
 - Questions addressing conditions and context under which we do research

WP 3

- “Meta-research” is the study of research itself: its methods, reporting, reproducibility, evaluation, and incentives ...
- Unobtrusive analyses based on publications and the information provided in them
- Large-scale quantitative analyses, combined with manual coding

Epistemic, genre, methodological, rhetorical, language features

Claims, effect sizes, sample sizes ...

Do we really need confidence intervals in the new statistics?

Stephen Gorard
Durham University, Durham, UK

ABSTRACT
This paper compares the use of confidence intervals (CIs) and a sensitivity analysis called the number needed to disturb (NNTD), in the analysis of research findings expressed as 'effect' sizes. Using 1,000 simulations of randomised trials with up to 1,000 cases in each, the paper shows that both approaches are very similar in outcomes, and each one is highly predictable from the other. CIs are supposed to be a measure of likelihood or uncertainty in the results, showing a range of possible effect sizes that could have been produced by random sampling variation alone. NNTD is supposed to be a measure of the robustness of the effect size to any variation, including that produced by missing data. Given that they are largely equivalent and interchangeable under the conditions tested here, the paper suggests that both are really measures of robustness. It concludes that NNTD is to be preferred because it requires many fewer assumptions, is more tolerant of missing data, is easier to explain, and directly addresses the key question of whether the underlying effect size is zero or not.

Introduction

This paper considers how to represent some of the key strengths or weakness of a research result, especially one expressed as an 'effect' size. Effect sizes can be of many kinds including odds ratios for cross-tabulated categorical variables, and correlation coefficients such as R^2 for real numbers related linearly, and all can be encompassed by the argument within this paper. However, for simplicity, the discussion here focuses on one type of effect size – the difference between two means divided by their overall standard deviation. Such an 'effect' size could be used in a cross-sectional study to illustrate the difference between the incomes of those based in urban and rural locations, or the examination results of two ethnic groups. The difference would not actually be an 'effect', because area of residence may not cause income level, for example. Effect sizes could be called standardised differences, and some kind of scaling is necessary (Gorard 1999). But they are generally called 'effect' sizes and so that is the term used in this paper. The term might be more appropriate when effect sizes are used to present the results of an experimental design.

In a typical experiment there will be two groups of roughly equal size to which cases will have been randomised – one for the intervention or 'treatment' and one for the control or 'business as normal' treatment. There will be a pre-specified measurable outcome, and the post-intervention mean score for that outcome will be calculated for each group separately, along with the overall standard deviation of the score. One way of presenting the results is to find the difference between the two means and divide the result by the overall standard deviation. If the resultant 'effect' size is at or near zero then the treatment is deemed to have had no effect relative to the control, or there

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KEYWORDS
Confidence intervals;
significance tests; new
statistics; number needed to
disturb; research
trustworthiness; analysing
social science data

Authors, affiliations, funding acknowledgements, keywords, journals, division of labour, gender ...

Citation/bibliographic databases:
Publication activity, profiles, citations, citation networks, classifications, retractions ...

Current work

Stratified random sample from WoS \approx 250.000 pubs from 2015

Social sciences and humanities

Mathematics and computer science

Life and earth sciences

Biomedical and health sciences

Physical sciences and engineering

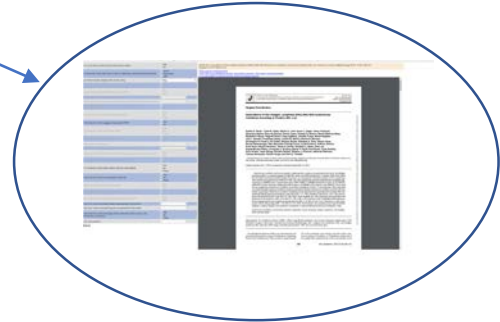
Full-text of 250.000 pubs



Full-text analyses

Sub-sample \approx 5,000 pubs from 2015

Manual coding and full-text analyses



352 journals

- Sociology
- Psychology
- Economics
- Management
- Physics
- Astronomy
- Chemistry
- Medicine
- Epidemiology
- Health
- Pharmacology
- Psychiatry
- Molecular biology & genetics
- Ecology
- Agricultural
- Plant/animal
- Multidisciplinary

(1) Is the article conducting a confirmatory study?	<input type="radio"/> Yes <input type="radio"/> No
(2) Does the study claim to be novel or a replication study (direct/conceptual)?	<input type="radio"/> Novel <input type="radio"/> Replication <input type="radio"/> Both
(3) What research design is the article using?	Vælg...
(4) Does the article explicitly coin expectations as "hypothesis/hypotheses"?	<input type="radio"/> Yes <input type="radio"/> No
(5) Are the expectations/hypotheses countable?	<input type="radio"/> Yes <input type="radio"/> No
(6) Number of expectations/hypotheses	<input type="text"/>
(7) Number of expectations/hypotheses that are (partially) empirically supported	<input type="text"/>
(8) Does the article find empirical support for the first presented expectation/hypothesis?	<input type="radio"/> Yes <input type="radio"/> No
(9) Does the article present positive finding(s)?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Partly
(10) Does the article engage in frequentist NHST?	<input type="radio"/> Yes <input type="radio"/> No
(11) Does the article use exact p-values?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Partly
(12) Does the article report asterisks?	<input type="radio"/> Yes <input type="radio"/> No
(13) Levels of significance	<input type="text"/>
(14) What is the study's sample size (units if longitudinal)?	<input type="text"/>
(15) Does the article mention the statistical power of the test prior to analysis?	<input type="radio"/> Yes <input type="radio"/> No
(16) Does the article calculate the statistical power?	<input type="radio"/> Yes <input type="radio"/> No
(17) Does the article report effect-sizes for main effects?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Partly
(18) Does the article use confidence intervals?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Partly
(19) Does the article report sigma-levels?	<input type="radio"/> Yes <input type="radio"/> No
(20) Does the article report "margins of error" or error bars?	<input type="radio"/> Yes <input type="radio"/> No
(21) Does the article use Bayesian inferential statistics?	<input type="radio"/> Yes <input type="radio"/> No
(22) How many numerated tables are presented in the article?	<input type="text"/>
(23) How many numerated figures are presented in the article?	<input type="text"/>
(24) Does the article encourage direct replication of the study in the discussion/conclusion?	<input type="radio"/> Yes <input type="radio"/> No <input type="radio"/> Partly
(25) Commentary	<input type="text"/>
Submit	

WANG, SS. Associations of Non-Hodgkin Lymphoma (NHL) Risk With Autoimmune Conditions According to Putative NHL Loci. American Journal of Epidemiology 2015. 181(6): 406-421.

Progress: 415 of 7536 (5.5 %)

- [This is not an empirical article](#)
- [if this PDF was uploaded incorrectly, click here to remove it. This action cannot be undone.](#)
- [if you are unable to code this article, send it to a senior reviewer.](#)



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Original Contribution

Associations of Non-Hodgkin Lymphoma (NHL) Risk With Autoimmune Conditions According to Putative NHL Loci

Sophia S. Wang*, Claire M. Vajdic, Martha S. Linet, Susan L. Slager, Jenna Voutsinas, Alexandra Nieters, Silvia de Sanjose, Wendy Cozen, Graciela S. Alarcón, Otoniel Martínez-Maza, Elizabeth E. Brown, Paige M. Bracci, Tracy Lightfoot, Jennifer Turner, Henrik Hjalgrim, John J. Spinelli, Tongzhang Zheng, Lindsay M. Morton, Brenda M. Birmann, Christopher R. Flowers, Ora Paltiel, Nikolaus Becker, Elizabeth A. Holly, Eleanor Kane, Dennis Weisenburger, Marc Maynadie, Pierluigi Cocco, Lenka Foretova, Anthony Staines, Scott Davis, Richard Severson, James R. Cerhan, Elizabeth C. Breen, Qing Lan, Angela Brooks-Wilson, Anneclaire J. De Roos, Martyn T. Smith, Eve Roman, Paolo Boffetta, Anne Kricker, Yawei Zhang, Christine Skibola, Stephen J. Chanock, Nathaniel Rothman, Yolanda Benavente, Patricia Hartge, and Karin E. Smedby

* Correspondence to: Dr. Sophia S. Wang, Division of Cancer Etiology, Department of Population Sciences, Beckman Research Institute of the City of Hope, 1500 East Duarte Road, Duarte, CA 91010 (e-mail: sowang@coh.org).

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Autoimmune conditions and immune system–related genetic variations are associated with risk of non-Hodgkin lymphoma (NHL). In a pooled analysis of 8,692 NHL cases and 9,260 controls from 14 studies (1988–2007) within the International Lymphoma Epidemiology Consortium, we evaluated the interaction between immune system genetic variants and autoimmune conditions in NHL risk. We evaluated the immunity-related single nucleotide polymorphisms rs1800629 (tumor necrosis factor gene (*TNF*) G308A), rs1800890 (interleukin-10 gene (*IL10*) T3575A), rs6457327 (human leukocyte antigen gene (*HLA*) class I), rs10484561 (*HLA* class II), and rs2647012 (*HLA* class II)) and categorized autoimmune conditions as primarily mediated by B-cell or T-cell responses. We constructed unconditional logistic regression models to measure associations between autoimmune conditions and NHL with stratification by genotype. Autoimmune conditions mediated by B-cell responses were associated with increased NHL risk, specifically diffuse large B-cell lymphoma (odds ratio (OR) = 3.11, 95% confidence interval (CI): 2.25, 4.30) and marginal zone lymphoma (OR = 5.80, 95% CI: 3.82, 8.80); those mediated by T-cell responses were associated with peripheral T-cell lymphoma (OR = 2.14, 95% CI: 1.35, 3.38). In the presence of the rs1800629 AG/AA genotype, B-cell-mediated autoimmune conditions increased NHL risk (OR = 3.27, 95% CI: 2.07, 5.16; *P*-interaction = 0.03) in comparison with the GG genotype (OR = 1.82, 95% CI: 1.31, 2.53). This interaction was consistent across major B-cell NHL subtypes, including marginal zone lymphoma (*P*-interaction = 0.02) and follicular lymphoma (*P*-interaction = 0.04).

autoimmune conditions; environment; genetics; interaction; human leukocyte antigen; lymphoma, non-Hodgkin; tumor necrosis factor

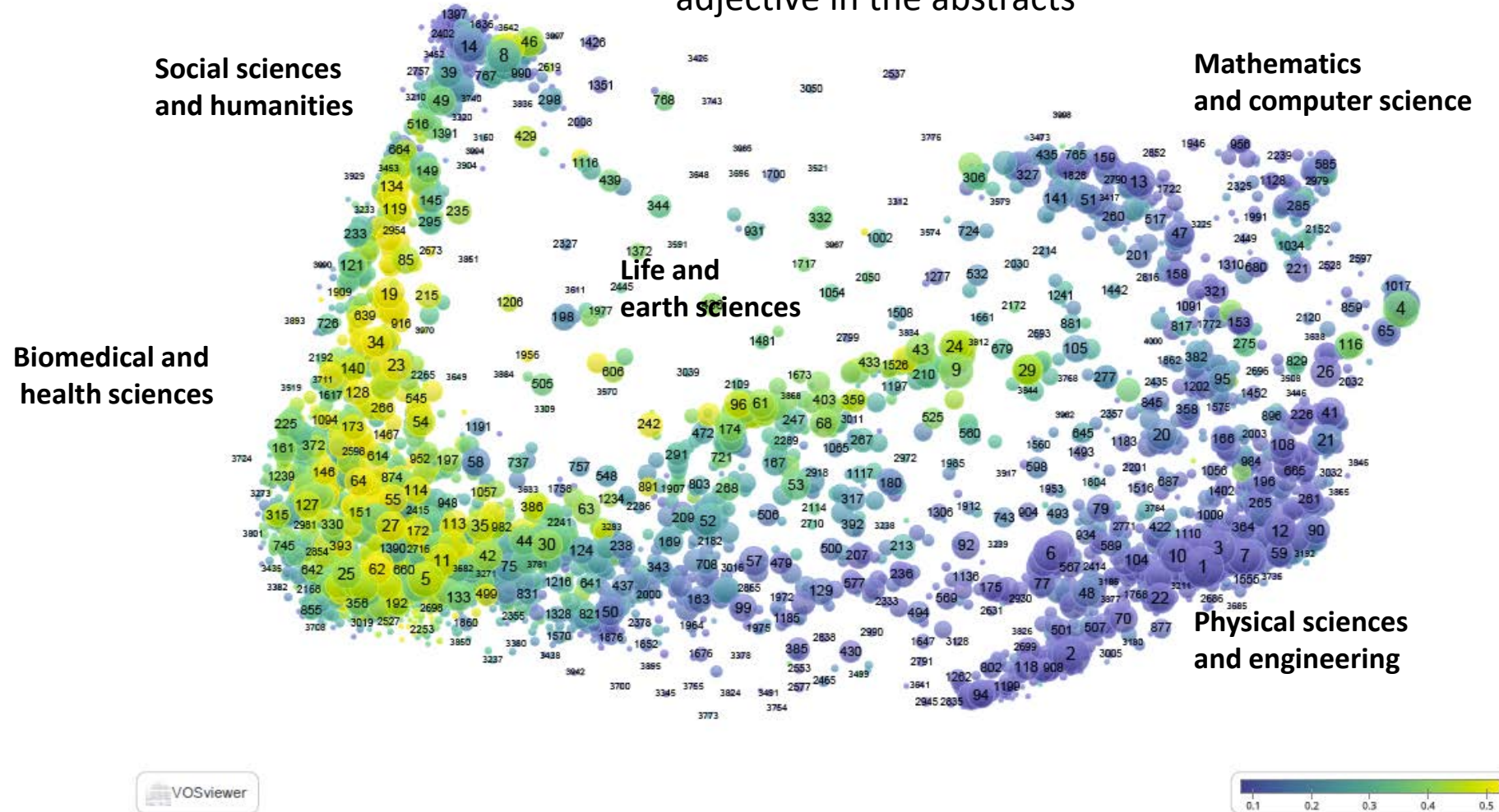
Abbreviations: CI, confidence interval; DLBCL, diffuse large B-cell lymphoma; *HLA*, human leukocyte antigen gene; *IL10*, interleukin-10 gene; InterLymph, International Lymphoma Epidemiology; MZL, marginal zone lymphoma; NHL, non-Hodgkin lymphoma; OR, odds ratio; SNP, single nucleotide polymorphism; *TNF*, tumor necrosis factor gene.

Non-Hodgkin lymphomas (NHLs) are a histologically and genetically heterogeneous group of malignancies originating from B- and T-lymphocytes. They account for approximately

3% of the worldwide cancer burden and show global variations in patterns of incidence (1). Populations at high risk of developing NHL include persons with severe immune system

The use of “significance tests” over fields

Map 6: Signifying results based on some stat test PLUS an adjective in the abstracts



Thank you for your attention!