Postprint of a Study on the Peer Review Mechanism for Registered Reports

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Abstract

[Purpose/Significance] The frequent "academic scandals" in recent years have posed new challenges to China's research evaluation mechanism. Registered reports, which have emerged within the open science movement, can effectively enhance transparency in research processes and evaluation stages, reduce publication bias during peer review, ensure academic rigor and research quality, and minimize academic misconduct to the greatest extent, owing to their unique peer review mechanism. This study analyzes the current status and characteristics of the peer review mechanism for registered reports, aiming to provide references for the innovative development and scientific improvement of peer review in China. [Methods/Process] Employing a combination of web-based research and content analysis, this study examines the peer review mechanism of registered reports from multiple dimensions including review process, review format, review efficiency, ethical guidelines for reviewers, and the construction of reviewer expert databases. It explores the relationships and relevant rights among authors, reviewers, and editors within this mechanism, and summarizes its key features. [Results/Conclusions] The innovative characteristics of the peer review mechanism for registered reports are mainly manifested in: Optimization of review processes and standards: Registered reports implement a novel two-stage peer review model that no longer relies solely on expert subjective judgment, while the processes of reviewer selection and handling of expert opinions are scientifically sound and rational; Improvements in review anonymity and interactivity: The peer review format is diversified, pursuing maximum flexibility while maintaining fundamental checks and balances; Enhancement of review efficiency: Parallel information transmission in peer review, codified regulations, and systematic monitoring and punishment mechanisms contribute to highly efficient peer review. The advanced characteristics of this mechanism are primarily reflected in: Establishment of a rigorous and detailed ethical normative system for reviewers; Emphasis on constructing peer reviewer expert databases to form a comprehensive incentive mechanism for reviewers.

Full Text

Research on the Peer Review Mechanism of Registered Reports

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Abstract: [Purpose/Significance] In recent years, frequent "academic scandals" have posed new challenges to China's scientific research evaluation mechanism. Registered Reports (RR), which emerged in the open science movement, can effectively improve the transparency of research and evaluation processes, reduce publication bias in the review process, ensure academic rigor and research quality, and minimize academic fraud through their unique peer review mechanism. This study analyzes the current status and characteristics of the Registered Reports peer review mechanism to provide references for the innovative development and scientific improvement of peer review in China. [Method/Process] This research comprehensively employs web-based investigation and content analysis methods to examine the review process, review forms, review efficiency, ethical guidelines, and reviewer database construction of Registered Reports peer review mechanisms. It explores the relationships and relevant rights among authors, reviewers, and editors in this mechanism and summarizes its key characteristics. [Result/Conclusion] The innovative features of the Registered Reports peer review mechanism are mainly reflected in: Optimization of review process and standards: Registered Reports implement a new two-stage peer review model that no longer relies solely on expert subjective judgment, while maintaining scientific and rational processes for reviewer selection and opinion processing; Improved anonymity and interactivity: The diversified review forms pursue maximum flexibility while maintaining basic checks and balances; Enhanced review efficiency: Parallel information transmission, codified regulations, and systematic monitoring and punishment mechanisms contribute to highly efficient peer review. The advanced features are mainly manifested in: Establishment of a strict and detailed ethical code system for reviewers; Emphasis on reviewer database construction with a comprehensive reviewer incentive mechanism.

Keywords: Registered Reports; Peer Review; Open Science; Review Model
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2 Literature Review

2.1 Research on Peer Review of Registered Reports We first searched Chinese databases CNKI and Wanfang using the search terms "Registered Reports AND Peer Review" in titles, but found no relevant research papers. We then expanded the search to "Registered Reports," "Registered Reports Sys-

tem," and "Registered Research" in titles, finding limited domestic research results. After manual screening, we identified only five relevant papers. Among them, Huang Guobin and Zheng Xia [4-6] detailed the "pre-registered research design" in the open science environment, systematically explaining the background, current status, content structure, publication process, and core value of Registered Reports. Huang Mincong [7] analyzed the transformative impact of the Registered Reports system on scientific journal publication and proposed suggestions for promoting its development in China. Li Xiaoli et al. [8] compared Registered Reports with traditional publication models from the perspectives of review cycle, publication duration, and dissemination effect, using the journal *Cortex* as an example, and summarized the advantages and limitations of Registered Reports. Overall, domestic research on Registered Reports is scarce and mainly focuses on general introductions of the new publication format, lacking in-depth exploration of its internal mechanisms and operational processes.

Internationally, we searched Web of Science and Scopus databases using "registered reports" AND "peer review" as keywords. After excluding editorial articles and database entries, only four English-language documents briefly analyzed Registered Reports from perspectives of academic value, early forms, and stylistic evolution. P. Clarke et al. [9] argued that Registered Reports should be actively introduced in health economics, as conducting peer review before experiments would greatly avoid bias and reduce research waste. M.R. Munafò [10] discussed the innovative peer review process brought by Registered Reports, suggesting through practice at the journal *Nicotine & Tobacco Research* that its peer review combines funding and publication decisions into a single, two-stage process, which is expected to greatly reduce reviewer burden and help reduce poor research practices and publication bias. C.D. Chambers et al. [11] analyzed the advantages of Registered Reports, arguing that their unique two-stage peer review mechanism can effectively address issues such as non-reproducibility of research results and publication bias, improving research replicability and providing incentives for researchers. They also noted that Registered Reports have limited applicability in hypothesis-free work or methodological studies, though they are actively expanding into new specialized fields. C.W. Jones et al. [12] believed that most journals' peer review processes do not effectively address selective outcome reporting, and used a stepped-wedge, cluster-randomized trial to study peer review in high-impact medical journals to find effective solutions.

2.2 Domestic and International Peer Review Research To deepen our understanding of the current status and frontiers of domestic peer review research and improve the relevance of our study, we systematically reviewed domestic literature on peer review from the past decade. We found that domestic research mainly focuses on introducing innovative foreign peer review mechanisms to address defects in traditional peer review. As early as 2011, Zhang Hao et al. [13] introduced foreign open peer review models and discussed their implementation in China. Subsequently, Liu Jingjing [14] surveyed foreign open-access journals and concluded that structured peer review, post-

publication open peer review, and third-party independent peer review could complement each other to better fulfill journals' roles as academic quality gatekeepers. Suo Chuanjun et al. [15] reviewed innovative practices in foreign journal peer review, analyzing their advantages and challenges and summarizing overall trends. Wang Rui et al. [16] discussed the concepts, processes, and pros and cons of group peer review and collaborative peer review in foreign academic journals. He Ying et al. [17] introduced the emerging concept of transparent peer review and constructed a corresponding development framework. Additionally, with the advent of the big data era, scholars have explored peer review innovation from various disciplinary perspectives, such as linguistics [18], scientific data [19], social policy [20], and big data environments [21].

Currently, international peer review research mainly falls into three categories: Empirical research revealing defects and problems in peer review practice, such as C. Ferguson et al. [22] discussing peer review fraud channels through a Korean plant researcher's case, and J. Bohannon [23] exposing the lack of peer review in many open-access journals using a deliberately flawed paper; Peer review innovation and improvement, such as J.H. Lee [24] introducing transparent peer review, and *Science* [25] announcing a peer review outsourcing project involving 15 journals; Comparative studies treating peer review as an evaluation method, such as D. Checchi [29] and G. Abramo [30] comparing peer review with bibliometric algorithms.

3 Research Methods and Data Sources

The Center for Open Science (COS) plays an important role in the development of Registered Reports and is currently the largest nonprofit organization 汇集推动 Registered Reports 出版的期刊数量. According to COS official statistics, as of March 1, 2021, 277 journals have adopted Registered Reports as regular or special issue content [31]. COS provides comprehensive, detailed, and universal guidelines on its website, including Registered Reports templates and submission guidelines. For instance, COS offers the "Registered Reports Guidelines" document containing reviewer and author guidelines [32].

We investigated the peer review guidelines of these 277 journals and found they can be divided into four types (see): Similar to COS standard guidelines (96 journals); With distinctive content sections and modifications (26 journals); Only simple statements without specific content (147 journals); No content, awaiting further details (8 journals). Only types 1 and 2 are meaningful for research.

Given the large number of journals, we adopted sampling survey following these principles (in ascending order of priority): Differences in peer review guidelines; Prior publication of Registered Reports; Ensuring disciplinary diversity to some extent; Different publishing platforms. Since type 1 journals have largely similar guidelines, we selected *Cortex*, the earliest journal to publish Registered Reports and one of the most prolific publishers, as a sample. Among the 26 type

2 journals, nine have published Registered Reports. Following the four principles, we selected seven journals, making a total sample of eight journals: *Cortex* [33], *Wellcome Open Research* [34], *Animal Behavior and Cognition* [35], *Applied Cognitive Psychology* [36], *International Journal of Eating Disorders* [37], *PLOS Biology* [38], *Journal of Child Language* [39], and *Journal of European Psychology Students* [40]. See for detailed journal information.

We employed web-based investigation and content analysis to examine the peer review guidelines of these eight sample journals. First, we selected and analyzed their peer review guidelines. Second, we conducted supplementary investigations on journal websites, such as "FAQ" and "About Us" sections. Third, we visited publishing platform websites to investigate general content or regulations applicable to these journals, combined with other external information sources like website announcements and editorials for comprehensive analysis. Finally, we organized the collected information to summarize the current status and characteristics of the Registered Reports peer review mechanism.

4 Research on Registered Reports Peer Review Mechanism

4.1 Peer Review Process The Registered Reports peer review process can be divided into two stages. We compare the specific implementation processes, content, and standards of the two-stage peer review. While relatively independent, the two stages have numerous internal connections regarding reviewer selection and opinion processing, which we also elaborate on.

4.1.1 Registered Reports Peer Review Process A complete Registered Report undergoes at least three review processes from creation to final publication: one editorial review and two peer reviews. The specific process is shown in [Figure 1: see original paper] [41].

(1) **First Review: Editorial Technical Review**. In Stage 1, authors submit a Stage 1 Registered Report including research questions, background, methodology, data collection methods, experimental arrangements, and analysis plans. The editor conducts an initial review, called technical review, to verify compliance with journal guidelines, including topic selection and formatting, and uses specialized software to check for plagiarism. Manuscripts failing technical review are directly rejected.

(2) **Second Review: Stage 1 Peer Review**. After passing technical review, manuscripts enter peer review. Editors invite experts to evaluate the manuscript, identify deficiencies, and propose revisions. After summarizing reviewer opinions, editors decide whether to return the manuscript for revision or reject it. If authors successfully revise according to reviewer comments and pass peer review, they receive an In-Principle Acceptance (IPA) notification from the journal, meaning that as long as they strictly follow the submitted research plan, the final results will be published regardless of outcome.

(3) **Third Review: Stage 2 Peer Review**. After receiving IPA notification, authors conduct the research, complete data collection, experiments, and analysis, and submit the complete research report. This document supplements the Stage 1 content and may refine background, methods, and analysis plans based on results. After submission, the second peer review occurs, similar in process to the first. Upon passing, the complete Registered Report is published.

4.1.2 Peer Review Content and Evaluation Standards Although the two peer review processes are similar, their standards differ significantly. In Stage 1, reviewers focus on [32]: (1) importance of research questions; (2) logicality and rationality of hypotheses; (3) soundness and feasibility of methods and analysis plans; (4) clarity and completeness of methodology description for replication; (5) whether authors have pre-specified sufficient outcome-neutral tests to ensure reproducibility.

In Stage 2, reviewers focus on [32]: (1) whether data can test hypotheses through approved outcome-neutral conditions; (2) consistency with Stage 1 submission; (3) whether authors fully followed Stage 1 protocols; (4) whether unregistered additional analyses are reasonable and meaningful; (5) whether data analysis supports conclusions.

Notably, reviewers do not evaluate based on subjective views about results (e.g., importance, novelty, clarity). The different review objects correspond to different information types, as shown in . Stage 1 evaluates pre-research planning information with more subjective standards (no reference), while Stage 2 evaluates post-research practical and conclusive information with more objective standards (with reference). This two-stage model optimally combines with the publication process to effectively reduce publication bias.

4.1.3 Reviewer Selection in the Peer Review Process Most journals publishing Registered Reports select 2-3 experts for external review. While no unified selection standard exists, the basic principle is consistent: reviewers' research areas must be relevant to the manuscript's subject matter. Editors have the greatest power in selection. To minimize individual subjectivity and prevent fraud, many journals disperse this power through checks and balances. For example, *Animal Behavior and Cognition* [42] allows authors to suggest at least three potential reviewers. *Journal of European Psychology Students* [40] invites authors to recommend reviewers or exclude specific ones. *Wellcome Open Research* [43] uses a computer-assisted algorithm based on previous review records to generate a list of most suitable reviewers for editors' reference.

For the two stages, at least one Stage 2 reviewer should have participated in Stage 1 review, being familiar with the research background and design. Simultaneously, at least one new reviewer is invited who is unfamiliar with the manuscript, avoiding preconceived notions and ensuring objective evaluation.

This combination effectively reduces biased decisions influenced by research results.

4.1.4 Handling Reviewer Comments in the Peer Review Process In Registered Reports peer review, reviewer opinions are transmitted to editors in parallel, who make decisions after comprehensive consideration (see [Figure 2: see original paper]). Reviewers' opinions remain independent, unaffected by other reviewers, maximizing judgment independence. Reviewer opinions do not directly determine manuscript acceptance but provide reference for editorial decisions. As *PLOS Biology* [44] states: decision-making is the editor's job. Editors evaluate reviewer suggestions and comments while considering author responses and other materials, ensuring reviewer opinions are appropriately considered even when final decisions differ.

This parallel communication model is not static. If a reviewer fundamentally disagrees with the manuscript and differs significantly from others, editors may share all reviews with each reviewer, requesting additional comments and justification before making a final decision, which may not follow majority rule.

4.2 Peer Review Forms Review forms determine the relationship between reviewers and authors. Common forms include: (1) Single-blind: authors cannot see reviewer identities; (2) Double-blind: neither party knows the other's identity; (3) Triple-blind: authors, reviewers, and editors are all anonymous; (4) Open: both parties know each other's identities, optionally after review completion.

Our investigation found no unified review type for Registered Reports. Most journals use traditional single-blind or double-blind forms (see). Some journals offer flexible options. *PLOS Biology* [44] defaults to single-blind but offers opportunities for signed and published review reports. *Animal Behavior and Cognition* [42] requires authors to recommend at least three potential reviewers before review, allows authors to request anonymity (double-blind) or not (single-blind), and allows reviewers to reveal their identities to authors (open). *Wellcome Open Research* [43] is the only journal in our sample that openly declares open peer review, using invitation-only reviewers whose names and affiliations are published with their reports.

4.3 Review Cycle According to Pubons' *Global State of Peer Review* report [46], reviewers average 19.1 days to complete a review after accepting the invitation, excluding time for editor-reviewer matching. This means the entire cycle exceeds three weeks even under optimal conditions. For Registered Reports, some journals have made explicit declarations. *Journal of European Psychology Students* [40] guarantees Stage 1 review within four weeks, with specific timelines: editors must assign manuscripts to 2-3 reviewers within one week; reviewers have five days to accept or decline; and two weeks to complete the review. Parallel opinion transmission ensures efficiency. *Cortex* [47] states Stage

1 review should be completed in 2-3 weeks (excluding author revision time). *PLOS Biology* [48] targets 10-day completion, requiring reviewers to contact editors if more time is needed.

Some journals have established monitoring systems. *Journal of Child Language* [49] tracks reviewer decline rates, average review time, and frequency. It also has a punishment mechanism: reviewers who consistently fail to respond, accept invitations without completing reviews, or submit unprofessional reviews are marked as inactive and eventually disqualified.

Compared with traditional papers, Registered Reports have shorter average review cycles and higher efficiency due to: parallel information transmission; explicit and strict time regulations providing institutional guarantees; supervision and punishment mechanisms constraining undesirable behavior.

4.4 Peer Review Ethical Guidelines To minimize bias from subjective factors, many journals have issued ethical guidelines for reviewers. *Journal of Child Language* [50], through Cambridge University Press, emphasizes timely reporting of conflicts of interest (COI) and details COI scenarios. *International Journal of Eating Disorders* [51], through Wiley, provides Committee on Publication Ethics (COPE) guidelines defining COI as situations where professional judgment about primary interests (research validity) may be influenced by secondary interests (financial benefits).

These guidelines also address confidentiality and timeliness. We summarize the requirements as: (1) **Timely COI declaration**: Common COI examples include recent/current collaboration or personal relationships with authors, direct competition, or profit opportunities. Transparency is key throughout. COI does not automatically disqualify reviewers but requires flexible handling. Reviewers must declare COI when submitting comments, and editors retain the right to reject their opinions. (2) **Recognizing unconscious bias**: Reviewers must acknowledge potential unconscious bias regarding authors' age, gender, institution, nationality, or ethnicity. Detailed documentation of reviewer comments, archived with manuscripts and verified by editors, minimizes such bias. (3) **Confidentiality**: In single- or double-blind review, confidentiality is crucial. Some journals create exclusive online review systems. Reviewers must treat manuscripts as confidential documents not to be shared. (4) **Quality and timeliness**: High-quality, timely reviews are essential for research dissemination. Reviewers unable to meet deadlines should promptly inform editors. Comments should be detailed, constructive, and evidence-based.

4.5 Reviewer Database Construction Reviewers are core to the peer review process. According to Pubons [46], reviewer completion rates are declining annually while invitation numbers grow by 9.8% and acceptance rates by 4.9%. Although Registered Reports reduce single-review workload, multi-round processes can cause fatigue. Therefore, journals are strengthening reviewer database construction.

4.5.1 Reviewer Selection Criteria Standards vary significantly. Some journals have specific criteria: *Journal of European Psychology Students* requires PhD-holding tenured professors and professional researchers in psychology. *Wellcome Open Research* requires PhDs, at least three first-author articles (one within five years), and reviewers from different institutions for each manuscript. Others have broader criteria: *Journal of Child Language* requires conference participation, relevant publications, and updated ORCID records. *Cortex* simply requires domain expertise, availability, and familiarity with peer review.

Selection methods include: online application; editor invitation; senior reviewer recommendation; academic institution recommendation. Diversified selection promotes talent flow and maintains high-quality reviewer pools.

4.5.2 Reviewer Incentive Measures Journals combine material incentives with humanistic care, though material rewards are limited. Humanistic measures include: free knowledge bases (e.g., *Cortex*'s "reviewhub" platform providing personalized profiles, certificates, annual reports, and Elsevier service discounts); free training courses designed by top journal editors and senior reviewers; certification upon completion; feedback mechanisms collecting reviewer opinions to improve systems. For example, after learning 90% of reviewers wanted to see final editorial decisions and other reviewers' comments, journals added this feature to online systems.

Overall, Registered Reports journals offer rich, diverse incentives focusing on reviewer capability enhancement and needs satisfaction rather than purely material rewards.

5 Characteristics of Registered Reports Peer Review Mechanism

As an emerging publication format with a unique two-stage process, Registered Reports exhibit innovative characteristics:

(1) **Optimized review process and standards**: The two-stage model no longer relies solely on expert subjective judgment. Stage 1 evaluates planning information subjectively without reference, while Stage 2 evaluates conclusive information objectively with clear reference. Reviewer selection incorporates author recommendations and computer assistance to constrain editorial power and ensure fairness. Opinion processing maintains reviewer independence while respecting their input.

(2) **Improved anonymity and interactivity**: Diversified review forms provide maximum flexibility within checks and balances. Journals grant authors and reviewers autonomous choice rights, enhancing three-way interaction under clear rules and constraints to preserve authority and fairness.

(3) **Enhanced review efficiency**: Parallel information transmission, codified regulations, and systematic monitoring/punishment mechanisms cre-

ate high efficiency. Review cycles are shorter than traditional journals due to scientific mechanisms and institutional guarantees.

The mechanism also demonstrates advanced features common to but more developed than traditional peer review:

(1) **Strict and detailed ethical code system**: Detailed guidelines minimize bias from subjective factors, providing specific measures for COI, unconscious bias, confidentiality, timeliness, and quality requirements, forming a scientific and flexible ethical framework.

(2) **Emphasis on reviewer database construction with comprehensive incentives**: Diverse selection methods (online application, editorial invitation, senior recommendation, institutional recommendation) promote talent flow. Incentive mechanisms focus on humanistic care and capability enhancement through learning platforms, free resources, training courses, and feedback systems.

This study analyzes the specific processes of Registered Reports peer review, explores the relationships and rights among authors, reviewers, and editors, and summarizes its characteristics. While Registered Reports are still evolving and have limitations (e.g., requiring more effort, risk of idea theft, applicability mainly to experimental sciences, low domestic popularity, limited disciplinary coverage), their peer review mechanism offers innovative features and advantages that provide valuable references for developing peer review systems in relevant disciplines in China.

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Author Contributions

Huang Guobin: Conceived the research topic and framework, revised and guided the paper.
Liu Lei: Collected and organized materials, primary author of the paper; Corresponding author, Email: alei5599@163.com.
Chen Li: Assisted in writing and revising the paper.

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Note: Figure translations are in progress. See original paper for figures.