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Registered Reports for Advancing Open Science and Their Value: A Postprint Study

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Abstract

[Purpose/Significance] The open science environment imposes higher demands on the transparency, rigor, and openness of scientific research. In this context, Registered Reports—an emerging publication format designed to effectively meet these requirements—have emerged, further promoting the development and evolution of open science. This paper aims to comprehensively introduce the background and development history of Registered Reports, seeking to identify their main functions and core values in advancing the open science development process.

[Methodology/Process] Using a combination of web survey method and content analysis method, this paper systematically reviews the basic overview of this emerging publication format from aspects including the background of Registered Reports, current development status, content composition, publication process, main functions, and core values.

[Results/Conclusions] The prominent characteristics of Registered Reports are mainly reflected in: In terms of content composition, Registered Reports include both final research results and detailed research plans; In terms of publication process, most Registered Reports are published in two stages. This emerging publication format helps reduce the occurrence of publication bias, standardize and innovate traditional publication processes, thereby improving the transparency, reliability, and rigor of research findings.

Full Text

Registered Reports and Their Value in Promoting Open Science Development

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Abstract: [Purpose/Significance] The open science environment places higher demands on the transparency, rigor, and openness of scientific research. In this context, Registered Reports—an emerging publication format designed to effectively meet these requirements—have emerged and further promoted the development and evolution of open science. This paper aims to comprehensively introduce the background and development process of Registered Reports and examine their main functions and core values in advancing open science. [Method/Process] This study systematically outlines the basic profile of this emerging publication by comprehensively applying network research methods and content analysis methods, covering its background, current development status, content composition, publishing process, main functions, and core values. [Result/Conclusion] The outstanding characteristics of Registered Reports are mainly reflected in two aspects: In terms of content composition, Registered Reports include not only final research results but also detailed research plans; In terms of publishing process, most Registered Reports are published in two stages. This emerging publication helps reduce publication bias, standardize and innovate traditional publishing processes, and thereby improve the transparency, reliability, and rigor of research results.

Keywords: Registered Reports; open science; open sharing

1. Introduction

Since the late 20th century, the open science concept centered on “freedom, openness, cooperation, and sharing” has gradually gained promotion and recognition. Especially in recent years, against the backdrop of rapid interdisciplinary integration, the demand for deeper, more sustainable, and broader scientific cooperation has gradually transformed research paradigms and knowledge exchange environments, creating an excellent historical opportunity for advancing the open science movement. As an academic movement aimed at achieving an open research culture and communication environment, the significance of open science lies not only in improving the quality and efficiency of scientific research and promoting the reuse of research results, but also in enhancing research collaboration and participation.

In this environment, preregistration—research documents created by researchers before collecting scientific data that are marked with temporal information and cannot be altered once submitted, permanently recording the implementation plan and technical route of a research project—has emerged. In the legal field, there is also a concept called “preregistration,” which is defined as “a special form of real estate registration.” However, the preregistration discussed in this paper refers to the process where researchers create research documents before data collection that are marked with time stamps and become immutable upon submission, permanently recording the implementation plan and technical route of a research project. Based on whether peer review occurs before data collection, preregistration can be divided into two types: “preregistration” without prior peer review, and “preregistration” that has undergone peer review be-

fore data collection, also known as “Registered Reports” (RR). As one type of preregistration, several international publishers have specifically introduced Registered Reports, making it an important frontier issue of recent academic concern. This format will evolve into a new scientific research method, enabling research work to focus more on the importance of research questions and the quality of research methods, eliminating the drawback of researchers or reviewers being distracted by research results, and fundamentally changing traditional scientific communication mechanisms. Specifically, by preregistering research plans before experiments, storing raw data during experiments in knowledge repositories, and publishing research results in academic journals after experiments, it ultimately achieves comprehensive open sharing of research results, research plans, experimental data, equipment, materials, and space. Therefore, this publication plays a tremendous role in ensuring the transparency, openness, and objectivity of research results and represents an innovative attempt to promote open science throughout the entire research lifecycle. Based on this, this paper attempts to systematically 梳理 the background, current development status, content composition, and publishing process of Registered Reports, and then analyze their main characteristics and important value in promoting the open science movement, in order to provide references for domestic theoretical research and practical exploration on the publication and sharing of scientific research results in an open science environment.

2. Literature Review

As early as the late 20th century, scholar A. Tonks introduced the “clinical trial registration mechanism” in medical research, which refers to the preregistration of important information related to trials through clinical trial registration agencies before conducting clinical trials, thereby providing reliable and transparent information to the public, clinicians, researchers, and funding agencies. Conceptually, this is similar to the basic idea of Registered Reports discussed in this paper, but it is limited to the medical field and can be regarded as the conceptual prototype of Registered Reports.

Considering the non-unified Chinese translation of “Registered Reports,” in May 2019, the authors attempted to search relevant literature in CNKI, Wanfang, and other databases using titles or keywords such as “注册报告,” “注册式报告,” “注册式研究报告,” “登记报告,” “登记式报告,” and “登记式研究报告,” but found no domestic research on this topic. Further searching Web of Science, Scopus, EBSCO, and ScienceDirect with “Registered Reports” or “Registered Report” as titles revealed that, aside from editorial articles or the publications themselves in the databases, only three foreign-language documents briefly analyzed them from the perspectives of academic value, early forms, and structural evolution. Among them, scholars J.A. Grand, S.G. Rogelberg, et al. outlined the procedures and characteristics of Registered Reports and results-blind reviewing, arguing that the important value of Registered Reports for current scientific practice lies primarily in emphasizing the rigor, completeness, and transparency

of the research process. Subsequently, scholars R. Wiseman and C. Watt used case analysis and comparative research methods to demonstrate a prototype of a Registered Report published in the 1970s in the *European Journal of Parapsychology*, finding that its relevant publishing policies were relatively loose and had not formed standardized formats compared to currently mature Registered Reports. Additionally, scholar A.R. Mehlenbacher also used case analysis to examine the basic process of evolution of Registered Reports from research articles to their current format, and conducted an empirical analysis of 32 Stage 1 Registered Reports, 77 complete Stage 2 Registered Reports, and 4 Registered Reports published in *Royal Society Open Science* in the life and psychological sciences, concluding that this publication has fundamentally changed the structure of research articles, making the entire process of scientific output more standardized and rigorous.

It was found that no research results on this publication have emerged domestically, while foreign studies mainly use case analysis or content analysis methods to focus on analyzing a certain component of Registered Reports, failing to comprehensively and systematically sort out the relevant overview of Registered Reports from dimensions such as emergence and development, basic concepts, content composition, and publishing process, causing considerable confusion for researchers to fully and deeply understand and grasp the development status, basic profile, and core value of this emerging publication.

3. Conceptual Definition of Registered Reports

The conceptual definition of “Registered Reports” should begin with the term “registered.” In the Chinese context, “register” means “to register or record.” From the perspective of the substantive relationships among relevant stakeholders currently involved in the publication of Registered Reports—including researchers, publishing institutions, and open science promotion platforms—the action of “registered” essentially means that after the creator of Registered Reports completes the writing and submission of Stage 1 Registered Reports (i.e., the preliminary research design submitted by researchers before collecting experimental data, containing only research hypotheses, methods, and analysis plans without research results or conclusions) and the publishing platform hires peer experts to review it and provide more standardized research modification suggestions, the creator submits it to a knowledge repository to complete the “registration,” forming a “registered protocol.” Subsequently, researchers supplement and improve it based on the collected research data to form Stage 2 Registered Reports (i.e., the research results formed after researchers collect experimental data, based on data analysis and processing results to improve the research hypotheses, methods, and analysis plans submitted in Stage 1, and supplementing with subsequent experimental analysis results, discussion, and conclusion modules). Thus, “registered” only represents that researchers preregister their preliminary research design before actually collecting experimental data, not to monopolize or conceal research topics and analysis designs,

but to obtain recognition from publishing institutions and review experts, and to advance the public release and implementation of scientific exchange of research ideas before research results are published through publishing channels. It is clear that “registered” is a series of control and management measures taken by Registered Reports creators and publishing institutions to clearly distinguish different research stages and reduce publication bias. From the perspective of the substantive content of scientific cooperation, the author believes that defining “registered” as “registered-style” is more appropriate.

Further analysis of the term “reports” in “Registered Reports” shows that this word is usually translated as “report” in Chinese. Combined with the content composition of Registered Reports, this publication represents systematic research findings formed after completing a scientific research project, including research objectives, content, methods, plans, results, discussion, and conclusions. Compared with traditional research reports, its content modules are not only more complete and detailed but also add the step of preregistering research plans before formally conducting research, making it a unique type of research report. Based on the above analysis, the author believes that translating “Registered Reports” as “注册式研究报告” (Registered-Style Research Reports) better conforms to its publishing process and essential characteristics.

Registered Reports are a new carrier for promoting the full-process sharing of scientific research in an open science environment. The essence is that in Stage 1, researchers submit a protocol (including research background, methods, and pilot results) to a journal, which organizes peer experts for review. Research plans that pass the review by the journal editors and peer experts are in principle accepted by the journal (in-principle acceptance), meaning that if the authors strictly follow the research plan to conduct subsequent research, the publication of the final research results will be substantially guaranteed. At this point, authors need to submit their reviewed research plan to a registration platform to complete preregistration, generating a “registered protocol” with temporal information that cannot be altered and serves as research evidence. The journal will then either publish it separately, archive it internally, or publish it together with the final complete Registered Report in the form of an effective link. In Stage 2, researchers begin collecting data and conducting experiments, then submit the research report generated at this stage (including the results and discussion from Stage 1) to the same journal, which invites peer experts for review. If approved, the journal publishes it, ultimately generating a complete “Registered Report.”

4. Background and Current Development Status

4.1 Background

For a long time, influenced by research result recognition standards or inertial thinking, the academic community and publishing industry have focused more on obtaining, retrieving, using, and publishing research results with significant

effects, emphasizing the novelty, originality, and significance of research conclusions, while rarely paying attention to the causes of negative results—whether they stem from low statistical validity, unreasonable research hypotheses, or unscientific experimental design. This has weakened the evaluation of research hypothesis rationality, review process rigor, statistical analysis reliability, and the necessity of replication studies, largely fostering undesirable practices such as publication bias and data manipulation in publishing. However, existing research shows that negative or replication studies are equally important in scientific practice, as they help reproduce and identify potential false-positive errors in original experiments, provide necessary support and reference for sample selection and environmental configuration in subsequent research, and build conceptual models and convenient pathways for other researchers to conduct similar studies. Therefore, establishing a more scientifically rigorous publishing mechanism to find an appropriate balance between improving research quality and promoting academic exchange has become an urgent problem for the academic and publishing communities.

According to research, as early as 1966, psychologist R. Rosenthal mentioned preliminary ideas about Registered Reports, arguing that the scientific community urgently needed to establish an evaluation mechanism based on research process rather than conclusions. Similarly, scholars R.G. Newcombe and G.W. Walster also believed that peer review of research designs before data collection would help improve research efficiency and reduce or avoid low-quality research work. However, when this concept was first proposed, its focus was primarily on better completing research work rather than providing solutions to problems in the research process, so it did not gain application, deepening, and practice in more disciplinary fields. The publishing community also attempted early Registered Reports publications. For example, Dutch Utrecht University psychology professor M. Johnson and fellow psychology researcher S. Schouten co-founded the journal *European Journal of Parapsychology*, whose core concept required researchers to write research plans before conducting studies and submit them to journal editors for review and evaluation to receive in-principle acceptance notifications. The ultimate goal was to reduce selection bias and prevent academic journals from being overfilled with research lacking rigor, standardization, and transparency by changing traditional publishing policies. Meanwhile, *European Journal of Parapsychology* also developed systematic and procedural plans to promote early Registered Reports publication, encouraging researchers to pre-submit their experimental protocols, sample sizes, number of trials, basic principles, and research hypotheses. However, because this journal failed to address issues such as the standardization and transparency of pre-submitted content and editorial review, and did not timely, appropriately store, publicly release, and disseminate researchers' registered plans, other research entities could not reproduce and verify research results, ultimately leading to the failure of early Registered Reports publication in further promotion.

In recent years, the academic community has begun to reattempt and successfully implement Registered Reports publication. According to research, the

earliest journal to explicitly propose and publish Registered Reports was *Cortex*, founded in 2013, which adopted the concept of scholar C.D. Chambers, requiring researchers to preregister and submit their research designs before collecting data, then submit them to journal editors and review experts for review and evaluation, aiming to improve research quality and effectively reduce various problems in the research process such as publication bias, p-hacking, and hypothesizing after results are known (HARKing). Subsequently, 80 scholars from epidemiology, genetics, psychology, neuroscience, clinical medicine, and other fields actively responded to *Cortex*'s innovation by signing an open letter to promote and publicize the core concepts and practices of Registered Reports and increase recognition and support for this publication in the scientific community. Meanwhile, *Cortex* developed policy guidelines to standardize the content composition and academic quality of Registered Reports, such as formulating standardized submission guidelines requiring authors to strictly adhere to key information and basic content required when writing Registered Reports at different stages, and developing modular review standards requiring editors, reviewers, and researchers to jointly participate in forming optimal research design plans.

The emergence of Registered Reports marks a re-examination of research practice and full recognition that standardized and rigorous research processes are necessary and sufficient conditions for forming reliable research results. Compared with traditional journal articles, this publication mainly changes academic publishing activities through two approaches: First, implementing a trial registration system that requires researchers to complete preregistration of their experimental designs through third-party service platforms, which can both help researchers establish academic priority and prevent them from selectively reporting research results during actual research. Second, completing peer review before knowing the results, where review experts conduct preliminary review of research designs without final results, then compare the consistency between the research design and final results, providing equal publication opportunities for positive and negative studies.

4.2 Current Development Status

To promote the dissemination and development of Registered Reports, academic journals, service platforms, academic databases, and funding agencies have joined the publication practice of this emerging publication. The following introduces the development status of Registered Reports in several main dissemination channels:

4.2.1 Open Science Center Created the “Open Science Framework”

The Center for Open Science (COS) is a non-profit organization developed in the open science environment to improve the transparency, openness, and rigor of scientific research. This organization created the Open Science Framework (OSF), specifically designed for preregistering research plans, publicly sharing

raw data and experimental materials, and enabling remote collaboration. This framework primarily serves the preregistration of Stage 1 research designs in Registered Reports, helping researchers register their research designs before data collection and generating research plans marked with temporal information that cannot be altered upon submission, permanently recording the implementation plan and technical route of a research project. This provides comprehensive information for other researchers, review experts, funding agencies, and publishing platforms to retrieve, reuse, evaluate, and verify the research design, thereby improving the reliability, transparency, and openness of research results.

4.2.2 Traditional Academic Journals Begin Publishing Registered Reports Traditional academic journals have begun exploratory practice in publishing Registered Reports. Figure 1 [Figure 1: see original paper] shows the number of Registered Reports published by different journals. As of May 2019, 31 journals had published Registered Reports, with a total of 168 published reports. Meanwhile, journals whose cumulative number of published Registered Reports accounts for more than half of the total mainly include *Comprehensive Results in Social Psychology*, *Social Psychology*, *Cortex*, *Frontiers in Psychology*, and *eLife*.

4.2.3 Academic Databases Provide Retrieval and Access for Registered Reports Academic databases are academic resource search platforms that collect cutting-edge academic resources and guide innovation in research value, committed to promoting the sharing, dissemination, and value-added utilization of knowledge resources throughout society, and playing an important role in promoting the modernization of cultural publishing undertakings and industries. Understanding the distribution profile of Registered Reports in academic databases is necessary to grasp the development status, academic value, and social recognition of this emerging publication. To this end, in May 2019, the authors searched different databases with “Registered Reports” as the title and found that major databases that have included Registered Reports mainly include Web of Science, ProQuest, Scopus, Wiley, ScienceDirect, and EBSCO.

Analysis found that although no database currently provides a specialized retrieval portal for Registered Reports, several major databases have begun to include this publication to promote its dissemination and development. Analysis of retrieval results from the six major databases that currently include Registered Reports shows that this publication has distinctive cataloging formats, usually featuring the words “Registered Reports” in the title to distinguish it from traditional research articles. Additionally, Web of Science, Scopus, Wiley, and EBSCO also include Registered Reports at different stages, noting “Stage 1 Registered Reports” or “Stage 2 Registered Reports,” and if content corrections are needed after publication, they are marked as “Correction Registered Reports.”

4.2.4 Citation Management Tools Compatible with Registered Reports The reference management tool Zotero has also joined the practice of promoting Registered Reports publication. Based on Google Scholar citation tracking results, fixed researchers timely collect and input Registered Reports currently published worldwide. Zotero provides information such as titles, authors, abstracts, source journals, languages, URLs, and storage locations of Registered Reports on its official website, facilitating users to further view or study them. Notably, Zotero currently provides 13 citation formats for Registered Reports, including American Psychological Association (APA Style), Modern Language Association (MLA Style), Nature, and Chicago Manual of Style (Chicago Style), strongly promoting the standardized citation of Registered Reports.

4.2.5 Funding Agencies Provide Financial Support for Registered Reports Publication To further explore and disseminate the academic influence and research value of Registered Reports, an increasing number of funding agencies are providing financial support for laboratories, research project teams, or academic journals to publish Registered Reports. Representative examples include Cancer Research UK, which provides research resource investment including funding, equipment, and facilities for research projects based on Registered Reports; and the Children’s Tumor Foundation, which partnered with PLOS ONE in 2017 to establish the “Drug Discovery Initiated Registered Reports Award,” which was ultimately awarded to three research teams from the Center for Human Genomic Research (CHGR), Westmead Children’s Hospital in Australia, and Massachusetts General Hospital, with funding amounts of \$85,000, \$84,000, and \$40,000 respectively.

5. Content Composition and Publishing Process of Registered Reports

5.1 Content Composition

To standardize the content format and writing standards of Registered Reports, the COS organization provides general writing guidelines that detail the core modules included in Stage 1 and Stage 2 Registered Reports. Table 1 briefly shows the content modules and detailed requirements for Registered Reports at different stages.

Analysis of Table 1 shows that from the perspective of content composition, Stage 1 and Stage 2 Registered Reports share many commonalities, both including basic research information (such as title, author, abstract, keywords, references, supplementary notes) and research methods and analysis plans. However, due to their different functions and purposes, the two stages have different emphases in content detail description. Specifically: Stage 1 Registered Reports emphasize research hypotheses, methods, and pilot data modules. Since this stage’s research document is only a research design submitted by researchers based on existing knowledge without actual scientific data support, it does not

yet involve results, discussion, and conclusion modules. Stage 2 Registered Reports condense, supplement, and optimize the content of Stage 1 Registered Reports. To help readers quickly grasp the research questions and final conclusions of Registered Reports, Stage 2 Registered Reports appropriately condense and refine the pre-submitted research methods and analysis plans, and supplement results, discussion, and conclusion modules on this basis, ensuring that the final published complete Registered Reports are well-founded and detailed.

5.2 Publishing Process

Compared with traditional academic papers, the publishing process of Registered Reports has distinctive characteristics, splitting the process into two stages based on before and after experimental data collection. Figure 2 [Figure 2: see original paper] clearly presents this process.

Specifically, the publication of Registered Reports requires the following steps:

(1) Writing and Submission of Stage 1 Registered Reports: Before collecting experimental data, authors must prewrite Stage 1 Registered Reports containing background introduction, research methods, experimental data collection plans, and research analysis plans, and submit them to academic journal editors for organized review. If approved, the journal will invite reviewers for further evaluation; if not approved, it will be rejected.

(2) Peer Review and In-Principle Acceptance of Stage 1 Registered Reports: After passing initial review, the journal editorial office will invite review experts to further evaluate Stage 1 Registered Reports, point out research deficiencies, propose revision suggestions, or reject them. During this process, reviewers will focus on: The importance of the research question; The logic, rationality, and theoretical basis of research hypotheses; The completeness of analysis methods, statistical power analysis, and analysis plans; The clarity, comprehensiveness, and accuracy of research method descriptions, and whether they are sufficient to provide a foundation for subsequent trials and analysis paths; Whether authors have preset methods for judging test results (such as positive controls and quality review) to verify the correctness of research hypotheses based on results. Stage 1 Registered Reports that pass peer review will receive an “in-principle acceptance” (IPA) notification from the journal, indicating that if authors strictly follow the submitted design plan to conduct subsequent research, the final research results will be guaranteed publication regardless of whether they show significant effects.

(3) Preregistration of Stage 1 Reports and Generation of “Registered Protocol”: After completing the writing, submission, revision of Stage 1 Registered Reports, and receiving the journal’s IPA notification, it means that the research design plan proposed by the researchers has been preliminarily recognized and supported. At this point, researchers need to complete the preregistration of Stage 1 reports through online registration platforms (such as Open Science Framework, AsPredicted.org, ClinicalTrials.gov, etc.), thereby

generating a registered protocol. The journal will then either publish, internally archive, or publish together with the final complete Registered Report the Stage 1 Registered Reports that have completed preregistration. Authors also have the right to choose whether to publicly release their research plans. If they choose to make them public, they need to indicate the registrant, registration identifier, and valid links associated with the registration platform on the front page of the final published Registered Report.

(4) Data Collection and Upload: In this stage, researchers must strictly collect and analyze experimental data according to the research plan outlined in the registered Stage 1 Registered Reports, and upload research products related to the research project, including raw data, experimental materials, and laboratory logs, to data repositories (such as Zenodo, Figshare, Harvard Dataverse, Dryad, Open Science Framework, etc.) based on the discipline category of the research project. They must also provide DOIs linking to the storage platforms in Stage 2 research reports for other researchers to share, verify, and reuse.

(5) Writing and Submission of Stage 2 Registered Reports: After completing experimental data collection and upload, authors begin writing and submitting Stage 2 Registered Reports. The content of this research document mainly includes: newly added experimental data with valid DOIs from this stage, research result analysis, discussion and conclusion modules, and supplemented and improved background introduction, research methods and analysis plans, and URLs of registered Stage 1 reports (if publicly released) based on data analysis results.

(6) Peer Review and Final Publication After Approval: Similar to Stage 1, academic journals will invite review experts to reevaluate Stage 2 Registered Reports. If approved, they will be published; if not approved, they will be rejected. It should be noted that the review panel evaluating Stage 2 Registered Reports mainly consists of two members: one is the external review expert who previously participated in the Stage 1 Registered Reports review and is already familiar with the research background and design plan, thus able to quickly grasp the consistency and differences between the two stages of research documents; the other is an external review expert specially invited by the journal who is not yet familiar with the basic outline of the research plan but can evaluate Stage 2 Registered Reports more objectively and fairly, effectively avoiding or preventing the first reviewer from making biased review decisions influenced by research results, forming a good review atmosphere where two review experts check and balance each other and cooperate fully. At this point, review experts will focus on evaluating: Whether the research hypotheses proposed by authors can be tested through neutral experimental conditions of experimental data (including quality review and positive controls); Whether the background introduction, experimental principles, and research hypotheses are consistent with the content submitted in Stage 1 Registered Reports; Whether authors strictly followed the preregistered research design plan to conduct research work; Whether the authors' newly added unregistered experimental analyses are reasonable,

whether methods are appropriate, and whether exact arguments are provided;

Whether experimental data can prove the research conclusions proposed by authors. After two-stage peer review, the complete Registered Reports are finally published.

Thus, not both stages of a complete Registered Report are freely accessible for readers to fully study. Regarding the subsequent placement of Stage 1 Registered Reports, journals may internally archive them, publish them in advance, or publish them together with the final complete Registered Report. Generally, Stage 2 Registered Reports are publicly published. That is, readers can retrieve Stage 2 Registered Reports through platforms that collect them, but may not necessarily obtain the corresponding Stage 1 Registered Reports.

6. Characteristics and Value of Registered Reports

6.1 Main Characteristics

Based on a comparison with traditional academic papers, OA papers, and data papers, this study summarizes the core characteristics of Registered Reports as follows:

(1) Content Composition: Compared with traditional academic papers, the content of OA papers has not fundamentally changed, only the cost for authors and readers to access papers has shifted. Data papers include scientific datasets, scientific data usage specifications, and research findings. The most prominent feature of Registered Reports in terms of content is the inclusion of detailed research plans. That is, in addition to elements appearing in traditional academic papers such as research background, methods, process, findings, and references, the final published Registered Reports should also include essential content modules not required in traditional academic papers, such as detailed research hypotheses (provided before formal research begins), introduced research methods and analysis plans, storage locations of registered research plans, and DOIs of raw data related to experiments.

(2) Publishing Process: Traditional academic papers, OA papers, and data papers all adopt a one-time publication format for final research results, while current mainstream Registered Reports publishing institutions adopt a two-stage publishing model: Stage 1, before collecting experimental data, Registered Reports publishing platforms require authors to submit research background, methods, analysis plans, and research hypotheses for initial evaluation by reviewers. If approved, they are published, internally archived, or published together with research results formed in Stage 2. Stage 2, after completing data collection, publishing platforms require authors to supplement and submit scientific data storage links, research process, results, discussion and conclusion, and supplementary information for reviewers to conduct a second evaluation before publishing the final complete Registered Reports.

6.2 Core Value

As an emerging publication based on empirical research, Registered Reports aim to promote scientific research based on hypothetical-deductive methods and provide optimal solutions to problems in the research process such as low statistical power, incomplete result reporting, and publication bias. Driven by Registered Reports, all stages of research work will be conducted transparently under public expectation and supervision, creating timely, efficient, transparent, and reliable research results, and helping to form a dynamic academic exchange ecosystem that is open, inclusive, and internally and externally linked under the joint participation of academic journals, funding agencies, researchers, review experts, and other scientific research entities. The important value of Registered Reports is mainly reflected in the following aspects:

(1) For Researchers: It helps them comprehensively and systematically sort out research ideas before actually conducting research, carefully and meticulously plan analysis paths, provide guarantees for the quality and efficiency of the entire research work, and thereby improve the academic influence of the final published scientific results. It helps researchers timely review, verify, and sort out research actualities through meticulously recorded and preregistered laboratory logs, discover possible errors or mistakes, and find new solutions and analysis methods. It also improves the visibility, credibility, and participation of other researchers or readers in published research work, helping them notice common pitfalls and solutions for similar research topics in subsequent research. Additionally, by prioritizing the registration and release of research ideas, researchers can enhance their academic influence and reputation, free themselves from passive research burdens, focus more on the long-term progress of scientific work, and transform external pressure into motivation for implementing research work, providing great convenience for other Registered Reports users to reference, reuse, and repurpose relevant research documents and data materials at any time. It also encourages researchers to make bold assumptions and 勇于实践 without worrying about their research results being affected by publication bias, creating a favorable academic atmosphere for more flexible selection of research topics, innovative research ideas, and optimization of research designs.

(2) For Academic Journals: Implementing a trial registration system will help them receive, report, and publish more precise, reliable, and high-quality research results, standardize and optimize the journal's review process and publishing workflow, provide timely feedback on submitted stage research results, and build a journal credit guarantee mechanism, thereby improving the journal's academic influence. The implementation of a two-stage peer review system helps reviewers more targetedly grasp, consider, and weigh the future development direction of research work when reviewing research design drafts before data collection, and then, under the institutional guarantee of the IPA notification provided by the journal, provide equal publication opportunities for research designs and results, negative and positive results, and evaluate research results more objectively and comprehensively, thereby largely reducing or avoiding pub-

lication bias. It also helps academic journals manage and organize research results more efficiently, transform workflows, expand business scope, provide new publishing format options, and reduce research result publication delays caused by resubmission and revision.

(3) For Open Science Promotion Platforms: It helps them further exert social and academic value, provides a reliable platform for researchers to openly share experimental materials, analysis codes, and other scientific data, facilitates researchers to reuse and repurpose existing raw materials, integrate and form scientific data from broader sources, and ultimately generate new research ideas and results, effectively improving the cycle and efficiency of scientific research. It helps open science platforms establish dynamic interactions and connectivity relationships with academic journals during the process of promoting Registered Reports publication, 促使 scientific research results to be retrieved, used, verified, and disseminated by research participants such as researchers, funding agencies, and the public along correct paths, thereby improving the visibility and academic reputation of open science platforms.

(4) For Research Funding Agencies: It helps them more conveniently, quickly, and accurately evaluate, predict, and position the economic benefits, social benefits, and implementability of research work based on detailed research design descriptions when making decisions on funding investment and project approval, thereby improving the efficiency of research funding use. It also helps research funding units gain benefits and improve their research recognition and influence by funding higher-quality Registered Reports. It also helps provide necessary funding and equipment support for effective communication, exchange, and cooperation between different countries, disciplinary fields, research laboratories, and researchers with open science as the core concept, ensuring the smooth conduct of scientific research review, management, and publishing activities.

As a beneficial attempt to promote the open science movement, Registered Reports have undergone nearly seven years of development since their formal publication in 2013. Currently, an increasing number of researchers, academic journals, research funding agencies, open science development platforms, and the public are joining the process of promoting Registered Reports. Its outstanding characteristics are mainly reflected in: comprehensive content composition, allowing authors to add exploratory analyses; implementation of a trial registration system in the publishing process; and adoption of a two-stage peer review system. In promoting open science development, the important value of Registered Reports includes: helping researchers more carefully and systematically sort out research ideas and more flexibly and autonomously select, use, and reuse scientific data; helping academic journals further standardize and optimize review systems and publishing processes, reducing publication bias; helping review experts, research funding agencies, and scientific data promotion platforms evaluate, grasp, and disseminate research results more accurately and rigorously.

However, consistent with the development barriers faced by open science that gave rise to it, as an emerging publication, the practical development of Registered Reports also faces some questions and problems, such as reviewers easily making judgments based on prior experience, cumbersome trial registration increasing researchers' burden, limited applicable disciplinary scope and research types, and the openness and standardization of research plans needing optimization. Nevertheless, the birth of Registered Reports marks that researchers have begun to re-examine whether their research practices follow the basic norms of scientific research standardization. With the active participation, cooperation, and promotion of an increasing number of research entities, Registered Reports will further solve practical problems in scientific research and disseminate the development concept of open science, ultimately achieving the goal of sharing academic knowledge and ensuring research quality.

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Zheng Xia: Material collection and organization, paper writing and submission.
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Research on the Registered Reports and Its Value of Promoting Open Science Development

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Abstract: [Purpose/significance] The open scientific environment puts higher demands on the transparency, rigor, and openness of scientific research. In this context, the emerging publication Registered Reports, which aims to effectively meet these requirements, has emerged and further promoted the development and evolution of open science. This paper intends to comprehensively introduce the background and development process of Registered Reports and attempt to examine their main functions and core values in promoting the development of open science. [Method/process] This study comprehensively uses network research methods and content analysis methods to systematically sort out the basic overview of this emerging publication from the aspects of its background, development status, content composition, publishing process, main functions,

and core values. [Result/conclusion] The outstanding characteristics of Registered Reports are mainly reflected in: In terms of content composition, Registered Reports include not only final research results but also detailed research plans; In terms of publishing process, most Registered Reports adopt a two-stage publishing format. This emerging publication helps reduce the occurrence of publication bias, standardize and innovate traditional publishing processes, and thereby improve the transparency, reliability, and rigor of research results.

Keywords: Registered Reports; open science; open sharing

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