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Image-based Academic Misconduct and Retractions Among Chinese Scholars: An Analysis Based on the Retraction Watch Database

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Abstract

Objective Based on the Retraction Watch database, this study investigates the current status of scientific image misconduct and conducts a descriptive analysis to provide data support for policy-making by research management departments. Methods Using “image” as the search keyword for the “Reason(s) for Retraction” field, all data related to image misconduct were retrieved from the Retraction Watch database. Combined with the Chinese Academy of Sciences Literature and Information Center Journal Partition Table, the data were encoded and analyzed across three dimensions: comparison between Chinese and foreign authors, publishing institutions and journals, and institution types and regions. Results The situation of image misconduct among Chinese authors is severe and currently at a high-incidence period, seriously affecting China’s academic reputation. The misconduct exhibits characteristics of concentration by discipline, region, and institution type. Conclusion It is recommended to establish an academic publishing image repository at the national level and concentrate efforts on developing image detection technology; establish an academic publishing ethics alliance to form a communication mechanism from journals to authors and institutions, and from the alliance to supervisory authorities, for efficient reporting of academic misconduct; promote changes to unreasonable evaluation systems to eliminate motivations for scientific image fraud at the source; and conduct educational campaigns on image misconduct in hospitals and medical schools while establishing punitive mechanisms.

Full Text

Retractions of Chinese Scholars' Academic Misconduct in Scientific Images: Analysis Based on Retraction Watch Database

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Abstract:

[Objective] Based on the Retraction Watch Database, this study investigates the current state of scientific image-related academic misconduct and conducts descriptive analysis to provide data support for research management policy formulation. [Methods] Using “image” as the search keyword in the “Reason(s) for Retraction” field, we retrieved all data related to image-based academic misconduct from the Retraction Watch Database. Combined with the Chinese Academy of Sciences Journal Citation Reports partition table, we coded the data and conducted three-dimensional analyses comparing Chinese and foreign authors, publishers and journals, and institution types and regions. [Results] The situation of image-based academic misconduct among Chinese authors is severe and currently in a high-incidence period, significantly impacting China’s academic reputation. The misconduct exhibits characteristics of concentration in specific disciplines, regions, and institution types. [Conclusion] We recommend constructing a national-level academic publishing image repository and concentrating resources on developing image detection technology; establishing an academic publishing ethics alliance to form efficient communication mechanisms between journals and authors/units, and between the alliance and supervisory institutions for reporting academic misconduct; promoting reform of unreasonable evaluation systems to eliminate motivations for scientific image fabrication at the source; and conducting education on image-based academic misconduct in hospitals and medical schools while establishing penalty mechanisms.

Keywords: retracted papers; image ethics; academic misconduct; Retraction Watch Database

In recent years, digitally manipulated images have become a hotspot for academic misconduct, showing a year-by-year upward trend. By early 2021, Academic Misconduct in Scientific Images (AMSI) had become the leading cause of paper retractions [?, ?], frequently triggering public opinion crises in China. The Ministry of Science and Technology investigated allegations by Elizabeth Bik and Rao Yi against several academicians and scholars suspected of AMSI, concluding that these constituted “image misuse” rather than “image fabrication,”

which sparked online questioning. Although the investigation report classified “image reuse” as “misuse,” international journals have imposed stricter penalties for similar behavior. In October of the same year, the journal *DNA and Cell Biology* retracted a paper with renowned physician Wen-Hong Zhang as corresponding author, citing “image reuse,” even though the first author had provided updated experimental images. This contrast again raised questions about whether China’s academic ethics standards are too low, severely impacting the nation’s academic image and making research on the current situation and trends imperative.

The high incidence of AMSI can be attributed to the central role of scientific images in scientific argumentation and the emergence of digital imaging technology. Quantitative studies of scientific papers across four centuries show that scientific images have gradually become core elements of scientific papers as evidence, with “the interaction between language and vision... constituting the core of scientific argumentation practice by the end of the 20th century” [?]. With the advent and widespread application of digital imaging technology, academic misconduct has targeted scientific images with immense argumentative value. Digital imaging technology enables non-standard processes modified according to subjective intentions, and the complexity of the data makes it difficult to identify and detect traces of image manipulation, facilitating image-based academic misconduct. The increased possibility of subjective intervention in image generation makes detecting and preventing AMSI challenging.

To address this challenge, AMSI has gradually become a research hotspot in relevant fields, with numerous publications focusing on prevention strategies for scientific journals [?, ?], digital image manipulation detection technology [?, ?], and scientific image ethics guidelines [?]. Douglas W. Cromey and colleagues discussed and attempted to establish ethical guidelines for scientific images within the academic community [?]. *Nature* reported on a paper image duplication detection software developed by a research team led by Dr. Daniel Acuna at Syracuse University as an important tool for preventing AMSI [?]. Professional “academic detectives” have even emerged in academia, with the most famous being Elizabeth Bik, who has published numerous AMSI investigation papers [?]. Chinese scholars and institutions have also conducted research in this area. Sun Liwei and colleagues primarily studied prevention strategies for scientific journals [?]; Ren Yanqing and colleagues discussed retracted papers from three dimensions—responsible subjects, responsible objects, and main causes—arguing that academic misconduct in images, data, and peer review presents new characteristics [?]; Ye Qing and colleagues collected and sorted image-related retraction records from the Retraction Watch Database and proposed countermeasures against image fabrication, manipulation, and plagiarism [?]; Duan Yaoyao and colleagues discussed the authenticity of medical paper images [?].

Many academic journals have also proposed specialized academic standards for scientific images and published articles on important events related to scientific image academic standards. Through summarizing past research in the field,

we found that most studies adopt a “blocking” approach to preventing AMSI. However, “blocking” is not the only governance method. To avoid falling into an endless cycle of “the more the Tao is elevated, the more the devil is elevated,” “unblocking” is equally important. To find pathways for “unblocking,” it is necessary to identify the most important sources and motivations of AMSI behavior and then adopt corresponding effective measures. Foreign researchers lack targeted in-depth analysis of Chinese-related behaviors and have failed to identify unique characteristics of Chinese scholars’ image-based academic misconduct, offering limited help in guiding Chinese AMSI behavior. This study attempts to use the Retraction Watch Database combined with the Chinese Academy of Sciences JCR journal partition database to retrieve information on international journals retracting Chinese scholars’ papers due to AMSI, analyzing dimensions such as journal type/level, region, and institution to identify characteristics of Chinese scholars’ image-based academic misconduct and explore the driving forces behind Chinese scholars’ image fabrication. Unlike passive “blocking,” the approach of this study is to find unblocking pathways at the source, reducing the occurrence of misconduct to make the defense lines established by journals more robust.

2.1 Data Sources

The survey data were obtained from the “Retraction Watch Database” (hereinafter abbreviated as RWD) [?]. Retraction Watch is a blog focusing on academic misconduct and specifically reporting retraction cases, created by scholars Adam Marcus and Ivan Oransky in 2010. In 2018, they collected and organized publicly reported retraction events into a database and released it online. The Retraction Watch Database is updated daily, with the earliest retracted paper dating back to 1756 (the earliest paper retracted for image reasons was published in 1979). As the most comprehensive and largest retraction database of its kind, it has been used by numerous academic misconduct researchers.

2.2 Data Screening

This study searched RWD using “image” as the keyword in the “Reason(s) for Retraction” field, retrieving 5,790 AMSI-related records, accounting for 13.28% of all 43,602 records (as of 00:00 on April 20, 2023). After using a web crawler tool to obtain the relevant data and store it in a MySQL database, we screened the data according to the following steps: (1) Exclude non-research papers: 5,572 research papers and 218 other types (including clinical observations, case reports, media news, etc.) were obtained by classification; (2) Filter retraction data: For research papers involving AMSI, there were four types of processing outcomes (retraction, correction, expression of concern, and others), among which 4,581 papers were retracted; (3) Confirm paper affiliation country: Since the country affiliation data in RWD contains inaccuracies, with some papers whose first authors’ nationality and affiliation do not belong to China also classified as Chinese papers, we screened out papers with first author nationality

from China, totaling 2,530 retracted papers.

During the data screening process, we found significant differences between Chinese and foreign data ($\chi^2=204.46$, $p<0.001$). If AMSI exists, Chinese scholars' papers are less likely to be corrected or receive expressions of concern and more likely to be retracted. Among all 5,572 research papers, China accounted for 51.08%, while the proportion of Chinese scholars' papers rose to 55.23% among those with the processing outcome of "retraction" (see Table 1).

2.3 Data Coding and Analysis Methods

After completing data screening, this study manually coded some fields. The coding table is detailed in Table 2.

The data were analyzed using tools such as SPSS 26 and Excel for descriptive statistics, chi-square tests, t-tests, and other analyses.

3.1 Comparative Analysis of Chinese and Foreign Trends

Analysis based on RWD's classification of AMSI found significant differences in misconduct categories between Chinese and foreign authors ($\chi^2=428.33$, $p<0.001$). As shown in Table 3, Chinese authors are mainly involved in image duplication and image disputes, with such behaviors significantly exceeding those of foreign authors. In contrast, foreign authors have higher proportions of obvious intentional fabrication behaviors such as image fabrication and image manipulation.

Analysis of retracted research papers from 2000-2022, counted by retraction year, revealed (as shown in Figure 1 [Figure 1: see original paper]) that foreign paper retractions began to surge around 2010, while China's retraction numbers exploded rapidly after 2019 and are still on an upward trend. Retraction events have some lag, so the trend of AMSI occurrence should be examined through paper publication dates. As shown in Figure 2 [Figure 2: see original paper], analyzing retracted research papers from 2000-2022 by publication date revealed that foreign image fabrication misconduct peaked during 2006-2015 and decreased year by year after 2013; China's related academic misconduct rose rapidly starting in 2012, reaching its current peak in 2019. The apparent decline after 2020 may be due to retraction cycles, indicating that image-based academic misconduct has not yet been fully discovered.

Analysis of average retraction cycles found that the retraction period for Chinese papers (Mean=1249.90, N=2917) was significantly shorter than that for foreign author papers (Mean=2206.11, N=2873), $t=-26.17$, $p<0.001$. Moreover, retraction cycles have gradually shortened in recent years (as shown in Figure 3 [Figure 3: see original paper]), indicating that the academic community's vigilance and attention to image-based academic misconduct have significantly increased, with more timely measures being taken.

3.2 Analysis of Publishers and Journals

Chinese authors' retracted research papers involved a total of 82 international academic publishers, with the top ten publishers by retraction quantity shown in Table 4. World-renowned academic publishers such as Elsevier, Wiley, Springer, and Taylor and Francis are all listed. Notably, the three major OA publishers—Frontiers, Hindawi, and MDPI—have also begun retracting Chinese authors' papers in the last five years, with quantities of 27, 53, and 17 papers respectively. However, compared to the huge number of papers published by these three major OA publishers, this retraction proportion is relatively small, which does not align with recent controversies surrounding paper quality and academic misconduct of these three major OA publishers and warrants attention.

Chinese authors' retracted research papers involved 468 journals. Among them, 113 were Chinese Academy of Sciences Top journals, accounting for 24.15%—nearly one-quarter of the total number of journals; Top journals accounted for 442 retractions, or 17.47%. SCIE-indexed journals numbered 351, accounting for 75.00% with 2,042 retractions (80.71%); non-SCIE journals numbered 117, accounting for 25.00% with 488 retractions (19.29%). Calculating retraction quantities by Chinese Academy of Sciences journal zones (as shown in Table 5) revealed that although there were no significant differences in the number of journals involved in each zone, retraction quantities varied considerably. Zone 3 journals had the highest average retractions per journal at 8.05, followed by Zone 4 (6.24) and Zone 2 (5.78), while non-SCIE journals (4.17) were even lower than Zone 2 journals.

Analyzing annual retraction quantities by zone in recent years (as shown in Figure 4 [Figure 4: see original paper]) shows that when retraction quantities were low in the early period, differences between zones were not obvious. However, since the outbreak began in 2020, Zone 1 journals have maintained relatively low retraction numbers, while Zone 2 and Zone 3 journals have seen significant increases in retraction quantities.

According to the discipline categories in the Chinese Academy of Sciences Literature and Information Center Journal Partition Table (Upgraded Version 2019-2022), most retracted papers came from Medicine (1,144 papers, 56.02%) and Biology (476 papers, 23.31%) fields. This proportion is also much higher than that of retracted papers by non-Chinese authors in SCIE journals, indicating that Medicine and Biology are the hardest-hit areas for image-based academic misconduct in China.

3.3 Analysis of First Authors' Regions and Institutions

After counting retractions by province, the top ten provinces were Shandong (413 papers, 16.32%), Jilin (195, 7.70%), Jiangsu (185, 7.31%), Guangdong (177, 7.00%), Henan (167, 6.60%), Shanghai (150, 5.93%), Beijing (117, 4.62%), Zhejiang (108, 4.27%), Shaanxi (103, 4.07%), and Hubei (101, 3.99%). Shandong is particularly severe, with retraction numbers more than double that of

the second-ranked province.

After coding first authors' affiliations by institution type into four categories—universities, research institutes, hospitals, and others—analysis revealed that nearly three-quarters of retracted papers came from hospitals, totaling 1,883 papers. Universities, research institutes, and other institutions accounted for 503, 131, and 13 retracted papers respectively, as shown in Figure 7 [Figure 7: see original paper].

There are also significant differences in retraction quantities by institution type across regions ($\chi^2=1232.02$, $p<0.001$). In some regions, the proportion of papers from hospitals is particularly high. As shown in Table 6, among the ten provinces with the most retractions, the top-ranked Shandong and second-ranked Jilin have the vast majority of retracted papers from hospitals, accounting for 89.59% and 94.87% respectively. Additionally, hospitals in Henan Province also account for 89.22% of that province's retractions. In contrast, Beijing (58.97%), Jiangsu (63.78%), and Zhejiang (65.74%) have relatively lower proportions of hospital retractions. Among all provinces, in retraction data where first authors are located in Hong Kong, Taiwan, and overseas, hospitals account for only 20.00%, 21.05%, and 5.08% respectively—far lower than mainland China.

From the perspective of publishers and journals, China's AMSI retractions exhibit characteristics of disciplinary concentration, zone concentration, and publisher dispersion. By discipline, Medicine and Biology are the hardest-hit areas, accounting for 79.33% of total retractions in SCIE journals. This is first because images play a crucial role in biological and medical research, such as microscope images, X-rays, MRI scans, and cell staining images, which serve as direct evidence of research results. Second, the complexity of image processing technology not only easily leads to errors by researchers but also poses challenges for reviewers' examination and verification. Third, Chinese researchers in biology and medicine face greater pressure to produce paper results for career development, making them more likely to pursue "idealized" or "reproducible" image data. By journal zone, China's image-based academic misconduct papers are concentrated in SCIE Zones 3 and 4 (according to Chinese Academy of Sciences partitions), with fewer in Zone 1 or Top journals. This indicates that top journals have stricter review requirements and higher fabrication difficulty; it may also be because top journals apply image detection technology more deeply and invest more human resources, making it more likely to detect image-based academic misconduct before publication, providing a reference for prevention strategies for other journals. Notably, the three controversial major OA publishers have been placed on warning lists by some Chinese universities, research institutes, and hospitals, yet their retraction quantities are relatively low, which does not indicate less image-based academic misconduct but rather potentially undiscovered problems requiring future research.

Analysis of first authors' affiliations and provinces reveals that hospitals have become concentration areas for image-based academic misconduct, producing

nearly 3/4 of retracted papers, suggesting strong fabrication motivations among physicians. Moreover, some provinces are exceptionally severe. Shandong Province, ranked first, accounts for 16.32% of retractions, with nearly 90% from hospitals. Jilin Province, ranked second, has nearly 95% of its retractions from hospitals despite having less than half of Shandong's quantity. These provinces warrant detailed case analysis. Compared to Chinese scholars in Hong Kong, Macau, Taiwan, and overseas, the huge proportion from hospitals is a unique characteristic of mainland China, suggesting institutional problems in mainland hospitals.

4 Recommendations and Implications

In recent years, frequent mass retractions of Chinese scholars' papers from international journals due to image-based academic misconduct have begun to affect the international image of Chinese academia, making urgent countermeasures necessary.

For the academic publishing community, preventing AMSI is relatively difficult, and with the combination of artificial intelligence technology and digital imaging technology, even greater challenges can be anticipated in the future. Therefore, comprehensive measures need to be constructed. Obvious measures include aligning with international academic publishing standards to establish strict image guidelines and introducing advanced image detection technology to improve screening accuracy. These measures have been elaborated in detail in previous studies and represent the publishing community's "blocking" approach to such misconduct. However, this study's data show that China's AMSI has unique characteristics, with its main source being "fabrication motivation" from policies targeting specific groups. If this motivation persists, blocking measures will be insufficient. Therefore, in addition to upgrading journal prevention measures, it is necessary to channel this fabrication motivation and establish joint governance mechanisms.

- (1) The data show that China's AMSI is relatively severe and difficult for individual journals to detect. Therefore, we recommend constructing a unified national academic image repository, for example, based on the China National Knowledge Infrastructure (CNKI) project, and building a technical platform for academic image detection on this foundation.
- (2) Referencing the Committee on Publication Ethics (COPE) mechanism, we recommend establishing a Chinese Academic Publishing Ethics Alliance and building a broader AMSI prevention mechanism on this basis: for disciplines such as medicine and biology that primarily rely on images for data presentation, the alliance should establish a shared database of original images; construct a shared high-risk author database within the alliance to mark unreasonable images and submitters during submission for preventive intervention when such authors submit again.
- (3) When handling papers suspected of image-based academic misconduct,

journals should actively provide feedback to authors and verify. For images that cannot be supported by sufficient original data, journals should promptly communicate with authors and take measures to reject (pre-publication) or retract (post-publication). For published papers that cannot obtain author responses, journals should contact the authors' institutions. When journals cannot coordinate with institutions' higher-level supervisory bodies (such as provincial health commissions that supervise hospitals), the alliance can assume the role of contacting and coordinating with higher-level institutions.

- (4) China's evaluation system for physician professional title promotion still has problems. Clinical physicians are required to be evaluated according to university research evaluation standards, which undoubtedly leads to misallocation of physician human resources. Provincial health commissions (especially in severely affected provinces such as Shandong and Jilin) should respond to the State Council's requirements for reforming and improving talent evaluation mechanisms, break the "four only" professional title evaluation criteria (papers, education, awards, and titles), and improve the promotion system for medical personnel by adding dimensions such as practical ability and medical ethics level. Flexible promotion indicators and channels should be formulated according to provincial conditions and position types, ensuring the feasibility of each indicator to avoid making papers the only viable option for medical personnel.
- (5) Conduct centralized academic ethics education activities for physicians and medical students in hospitals and medical schools, and establish relevant punitive measures, such as revoking professional title evaluations, honorary titles, and project funding that include academic misconduct papers in application materials.

Although detection technology advances with each passing day, new fabrication technologies will emerge accordingly. Therefore, we need to effectively curb China's scientific image academic misconduct at the source, strengthen academic ethics education related to AMSI, avoid "paper-only" orientation in promotion, build an academic publishing ethics alliance, share AMSI data, and achieve tripartite linkage among journals, author institutions, and higher-level supervisory bodies. Specifically, we can reform the scientific research evaluation system by introducing more diversified evaluation indicators to encourage researchers to conduct authentic and reliable research activities, while emphasizing implementation and feedback of the system to ensure execution progress across provinces and regions. Only in this way can we fundamentally reduce AMSI occurrence.

This study aims to deeply explore the root causes of Chinese scholars' academic misconduct in image processing to implement interventions at the source and reduce such behavior. However, as retraction is the ultimate outcome of this problem, the real reasons behind it can only be inferred from existing clues, adding complexity to the research. To obtain more accurate reasons, we also

need to employ qualitative research methods such as interviews and questionnaires for in-depth exploration. However, due to the negative nature of academic misconduct, respondents may resist such research and be unwilling to accept investigators' surveys, undoubtedly increasing research difficulty. Additionally, the lack of AMSI data from the submission stage limits the dimensions of our analysis and may affect the depth and breadth of the research. Therefore, we need to find more data sources and research methods to understand this issue more comprehensively and deeply.

Although the findings of this survey are shocking, we should still recognize the positive signs emerging. Recently, the Guangdong Provincial Department of Human Resources and Social Security, Guangdong Provincial Health Commission, and Guangdong Provincial Administration of Traditional Chinese Medicine jointly issued the "Implementation Plan for the Reform of Professional Title Evaluation for Health Professionals in Guangdong Province," which explicitly requires emphasizing the evaluation of clinical practice ability and no longer making papers a necessary condition for professional title application [?]. The continuous introduction of such measures is believed to effectively change the current high-incidence situation of image-based academic misconduct.

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Author Contributions:

Author 1: Proposed research direction, designed research plan, analyzed data, created visualizations, drafted manuscript;

Author 2: Conducted literature review and organization, collected data, cleaned data, coded data, participated in manuscript writing.

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

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