Original article

Retracted articles by Croatian authors: a case study

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Abstract

Objective
To calculate the number of scientific articles published but later retracted, to analyse the reasons for the retractions, and to compare the results with those from EU countries comparable to Croatia in terms of expenditure on R&D and the number of active researchers.

Methods
We searched for retracted articles published between 1990 and 2017, with at least one Croatian author, indexed by the Web of Science Core Collection (WoS CC) and identified those that had been retracted (as ascertained from the Retraction Watch database). The number of such articles was compared to the number similarly arrived at for three other EU countries. The retraction notices of the Croatian articles were scrutinized to determine the date and the reasons for retraction.

Results
Of the 17 articles the retraction of which could be verified in the original source and/or from a retraction notice, four had been published in Croatian journals. The time from publication to retraction ranged from one month to nine years. Most such articles belonged to the field of biomedicine, and more than a half were retracted because of scientific misconduct (plagiarism and redundant or duplicate publication).

Conclusion
The number of retracted articles by Croatian authors was relatively small compared to the total number of articles indexed in WoSS CC, and the proportion was not significantly different from that from comparable countries.

Keywords
Conflict of interest, duplication, plagiarism, retraction, scientific misconduct

Introduction

Over the last few decades, the number of retracted scientific articles has increased from fewer than 100 a year before 2000 to nearly 1000 in 2014.[1] The rising number may indicate greater awareness of, and response to, fraudulent or sloppy research[2] on the part of researchers and journal editors because the majority of retractions are due to major misconduct (fabrication, falsification, and plagiarism) or other questionable research practices such as fake peer reviews.[1]

Retraction has become the main mean of drawing attention of the academic community to scientific misconduct.[3] According to the Committee on Publication Ethics (COPE), journal editors should consider retracting a publication if they have a clear evidence that the publication is a 'result of misconduct or honest error, unethical research process, or is redundant or plagiarized.'[4] Scientific journals should retract individual articles by publishing notices as soon as any form of misconduct comes to light. COPE Retraction Guidelines recommend that retracted articles be properly labelled for clear and easy identification in bibliographic databases.[5,6]

The number of articles by Croatian authors indexed in international bibliographic databases has been steadily growing. For example, the number of such articles and reviews published in journals indexed by the Web of Science Core Collection (WoS CC) during 2000–2004 was 7271, which tripled to 24,341during 2014–2018.

Our main goal was to count the number of scientific articles by Croatian authors published between 1990 and 2017 but later retracted, to analyse the reasons for the retractions, and to compare the results with those from EU countries comparable to Croatia in terms of expenditure on R&D and the number of active researchers.

Methods

Database and search
The Web of Science Core Collection was chosen as the data source because of its multidisciplinary coverage and the ease with which retracted publications can be located. The search was conducted using "Croatia" or "Hrvatska" in the address field and "retracted

publication" or "retraction" in the document types field. The search was limited to articles published between 1990 and 2017, inclusive.

The Web of Science describes a retracted publication as 'an article that has been withdrawn by an author, institution, editor, or publisher because of errors or unsubstantiated data' and a retraction as 'a public notice that an article should be withdrawn because of errors or unsubstantiated data.'[7]

Retraction Watch Database (http://retractiondatabase.org/RetractionSearch.aspx?)[8] was searched as a supplementary source, using the term "CROATIA" in the country field. The searches were concluded in January 2019.

Classification of retraction notices

Each retraction notice was scrutinized to determine the reason for retraction, and the remarks, if any, made by the editors or authors were noted. We also checked the data in the RWD for other relevant information.

The retracted articles were classified based on the broad academic discipline, reasons for retraction, publishing and retracting data, and the authority that requested the retraction.

Comparison with other EU countries

Similar searches were conducted for authors from EU countries comparable to Croatia in terms of the expenditure on R&D as a percentage of the gross domestic product (GDP) and the number of active researchers.

By using Dixon's Q test for outliers, we tested whether these countries differed from Croatia in their retraction rates (number of retracted articles for every thousand articles published during 1990–2017 in journals indexed in WoS CC).

Results

We found a total of 19 unique records of retractions by Croatian authors, 12 in the WoS CC database and seven in the RWD database (Table 1; a complete list is given in Supplementary Table 1).

For two out of the 12 WoS CC articles labelled as retracted, we did not find a retraction notice or any other indication of retraction in the respective journals in which those articles had been originally published, nor were these articles found in the RWD list. This was probably an error in indexing, and we excluded these articles from further analysis. The final number of records from WoS CC was therefore ten. None of the seven articles from the RWD database was found in the WoS CC database.

Of these total 17 articles, most (13 out of 17) had been published in international journals and the remaining four, in Croatian journals.

Research articles accounted for 13 of the 17 retractions; clinical studies, reviews, and editorials accounted for one each; and one was retracted while still in press. Except the article in the field of education, all the rest were from the physical and biological sciences, and most were in the biomedical category (Table 1).

The retracted articles had been published between 2000 and 2016, and the time from publication to retraction ranged from one month to nine years (Table 1). The lag between publication and retraction was between nine months and six

Table 1. Retracted papers according to the year of publication (n = 17)

Variable	Number of items
Indexing	
WoS CC indexing	10
Retraction Watch	7
Article type	
Review	1
Research Article	13
Other (E, CS, IP)	3
Publisher	
International	13
Croatian	4
RWD covering	17
Subject category	
Biomedical sciences	11
Social Sciences	1
Other	5
Reasons for retraction	
Overlap or duplication	7
Plagiarism	5
Honest error	2
Other	3
Retracted by	
Editor/publisher	8
Author	5
Both	4
Full text availability/ marked as retracted	10
Retraction time	
Minimum	1 month
Maximum	9 years
Median (25-75 percentile)	2 years (1–4.5 years)

Legend: WoS CC – Web of Science Core Collection; JCR – Journal Citation Reports; RWD – Retraction Watch Database; R –review article; RA – research artricle; E – editorial, CS – clinical study, IP – in press, Cro – Croatia; Int - international

for international journals, with two exceptions: two articles were retracted while still in press, and one was an accidental duplicate, due to a publisher's overlooking prior publication. For the articles published in Croatian journals, retraction took longer, between two and a half and nine years.

Of the total 17 retractions, 8 were at the behest of the editors or publishers: three because of plagiarism, four because of overlap with earlier publications, and one because it was an accidental duplication that had been overlooked by the publisher. The authors and the journal editors agreed to retract four articles: three because of overlap with earlier

publications and one for unknown reasons. The remaining five articles were retracted by the authors themselves: two because of plagiarism, one because of incorrect reporting of conflict of interest and methodological inconsistencies, and two because of major errors in analysis. Full texts of ten retracted articles were properly labelled or watermarked and accessible online from the publisher websites. In one case, full unmarked text was found in an institutional repository. Six articles were not accessible, the withdrawal notices being the only pointer to the retraction.

One paper indexed by the WoS CC was not labelled as retracted: its retraction notice was indexed as a correction. However, the authors had retracted the entire article because of incorrect data (full text of the article is available, properly watermarked, on the publisher's website).

The number of retractions from Croatia was compared to that from three other EU countries similar to Croatia in terms of the proportion of GDP spent on R&D (Table 2). All the four countries turned out to be more or less similar in terms of the rate of retractions.

Table 2. Proportion of retractions of scientific articles by authors from four European countries comparable in terms of the proportion of their GDP spent on R&D and number of active researchers

Country	Expenditure on R&D as a proportion of GDP (2016 data)	Active researchers* (thousands) 2016	Articles and reviews in WoS CC journals (1990–2017)	Retracted articles	Proportion of retractions (‰)
Croatia	0.84	<11	73,258	12	0.00016
Bulgaria	0.78	>15	62,713	3	0.00005
Lithuania	0.74	<10	37,652	1	0.00003
Slovakia	0.79	<15	75,048	8	0.00010

*full-time equivalent[9]

Discussion

Only 12 out of 73,258 contributions by Croatian authors published during 1990–2017 and indexed by the WoS CC were retracted (Table 2), a proportion consistent with the results of other, more comprehensive, studies, which also showed the proportion to be very small.[1,10]

All the retracted articles except one were from the physical, biological sciences and medicine, two-thirds of them being in the field of medicine. Several studies have shown that retractions are not uncommon in biomedicine, where data fabrication and falsification, as well as inappropriate reporting, have serious implications not only for further research but also for everyday clinical practice.[11,12]

According to Bar-Ilan and Halevi, the reasons for retraction can be grouped into three main categories: ethical misconduct (for example plagiarism and redundant or duplicate publication), scientific distortion (manipulated or fraudulent data, unsupported conclusions, non-replicability, etc.), and administrative errors (accidental duplicate publication).[13] Bar-Ilan and Halevi maintain that articles from the second category may have serious negative implications for the scientific process. Feng and co-authors also suggest that for the health of the scientific endeavour, eliminating or reducing fraud and error in scientific publishing should have priority over plagiarism and duplicate publication.[14] In the Croatian sample, 3 articles were retracted because of error or fraud and most others, because of misconduct.[15]

Retraction is possible only when a publication is scrutinized and a significant error or some other cause for concern is found.[15] In the present study, the lag between publication and retraction ranged from 1 month to almost 9 years; for international journals, it was between 9 months and 6 years, and for the articles published in Croatian journals, retraction took longer, between 2.5 and 9 years. Every retraction is a setback for all the parties involved in the publication—authors, journal editors, and reviewers, especially in a small academic community.[15] When the retraction process 'involves powerful and prestigious individuals',[16] the retraction time is even longer.

In terms of the number of contributions, Croatia ranked between Slovakia and Bulgaria whereas in terms of the proportion of retracted articles, it was not significantly different from the other countries. These findings motivate us to continue to monitor retractions, especially because all these countries are in economic transition, undergoing educational reforms and social transformation. Furthermore, none of these countries has efficiently implemented and coordinated the national guidelines for ethical conduct of research[17] ; even when guidelines on good research practice at the institutional level are available, compliance with them is not mandatory.[18,19] The extent to which scientific journals from these countries adhere to international publishing standards and strive to raise their authors' awareness of academic integrity also remains uncertain.

Although education is often recommended as the means of preventing misconduct,[20,21] a Cochrane systematic review showed little evidence of the positive impact of any action aimed at preventing misconduct and encouraging integrity in research and publishing; however, awareness of plagiarism and practical training in the use of text-matching software can contribute to preventing misconduct.[22]

The limitation of the present study is the small size of the sample: 17 retracted articles make up a sample that is probably too small to allow any general conclusion.

Despite the manyfold increase in the number of articles

published by Croatian authors in internationally visible journals, the number of retracted articles is very small, not significantly higher than that from other comparable countries, and has not been rising. In addition, many Croatian higher-education institutions now offer training in research methods and ethics as well as in using text-similarity software for detecting plagiarism. Through mandatory graduate and postgraduate courses, students have been made aware of individual and institutional responsibilities in conducting research and in reporting its results. We believe that authors' publishing behaviour may be positively influenced by emphasizing the importance and principles of responsible research conduct and citing examples of improper practices. A part of the responsibility also lies with journals, which should maintain high ethical and methodological standards in selecting manuscripts for publication.

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