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# **Bibliometric indicators of Croatian clinical medicine research after joining the EU: interrupted time series analysis<sup>1</sup>**

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## **ABSTRACT**

**Background:** After the fall of communism, post-communist Central and Eastern European (CEE) countries struggled to advance to the level of Western European countries of similar sizes, both in quality and quantity of their publication performance. (Gui et al., 2019; Hu & Zhang, 2017; Jurajda et al., 2017) The same may apply to the field of medicine, where CEE countries still function on the basis of individual work and personal connections, with few publications in higher impact journals. (Jovanovic et al., n.d.)

Being a researcher in a country with lower research performance has an effect on the extent of publication and the development of international collaborations. (Pina et al., 2019) Entering the European Union has made some difference in that field, as shown on the example of Malta and several other countries. (Makkonen & Mitze, 2016; McMillan et al., 2016)

**Aim:** We aim to test the hypothesis that the number and quality of publications by Croatian authors in the field of clinical medicine has increased after Croatia joined the EU.

**Methods:** Bibliometric data for publications indexed in Web of Science: Core Collection (WoS:CC) and Scopus, and authored or co-authored by researchers with a Croatian affiliation in clinical medicine were collected via inbuilt export for two time periods: 2005-2013 and 2014-2022.

The sample for the study were all publications with a Croatian affiliation indexed at the times of data extraction for the period between 2005 and 2022 in WoS:CC (n=113,695) and Scopus (n=122,932). Minimal sample size with the desired precision of estimate of 0.05 and

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confidence level of 95% was estimated at 385. However, we aimed to include all publications with a Croatian affiliation in clinical medicine in both databases.

Using public domain records and lists, especially the list of registered subjects, provided by government and public, government-run institutions, a list of all possible names for all types and forms of organizations dealing in clinical medicine were gathered. Names which shared the same relevant words, such as hospital, were grouped under a single term. Terms were then truncated to include all possible and relevant variants, e.g. hosp\* for hospital, hospitals, hospice and hospices. Truncated terms, which included terms with two or more truncated and non-truncated words, were connected with Boolean operator OR and put in brackets. Brackets were then combined to include only the results with Croatia in the affiliation, retrieving only works with a Croatian affiliation in the field of clinical medicine.

Interrupted time-series analysis (ITSA) was performed according to the Cochrane Effective Practice and Organisation of Care (EPOC) Resources for Review Authors. (Cochrane EPOC, 2017) We calculated pre- and post-intervention (membership in EU) coefficients and change in slope of the annual value of indices, which may indicate if the intervention observed had an actual impact on possible changes. Programming language Python and Ordinary Least Squares method were used to calculate and visualize ITSA.

Indicators compared were number of authors, number of publications, times cited (total, total without self-citations, and self-citations), average citation count per item, and h-index. Citation related indicators were observed yearly. As Scopus gives less data than WoS:CC, the analysis for Scopus lacks the number of authors, the times cited – without self-citations, and the self-citations indicators. All citation-related indicators were shown for the 2007-2020 time period, because 2021 and 2022 were removed as outliers, and 2005 and 2006 had to be removed to preserve the symmetry.

In addition, the number and percentage of original research (journal articles and reviews) in the number of all types of publications were compared, as possible indicators of increase in quality of publications before and after Croatia joining the EU.

**Results and Discussion:** The analyses showed that the number of authors, publications, journal articles and reviews increased significantly compared to the model predictions. No citation-related indicators showed any increase significantly related to the intervention.

EU membership may be used to predict 93.2 % of author number increase in WoS:CC, 95.7 % (WoS:CC) or 87.9 % (Scopus) of publication number, and 95.2 % (WoS:CC) or 88.7 % (Scopus) of journal articles and reviews.

**Conclusions:** A positive impact of EU membership on a small country's number and perceived quality of publications may help Croatia's decision-makers when deciding on joining other such communities, as well as decision-makers in similar countries when deciding whether to join the EU or not. In addition, it might instigate others to conduct similar studies to see the full impact that formal international relations may have on science and scientific production.

## KEYWORDS

bibliometric analyses; bibliometric indicators; clinical medicine; Croatia; European Union membership

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