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Potentials and controversies in open access publishing: a spotlight on medicine

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Abstract:

The paper gives an overview of open access publishing (OAP) within the medical field. Tracing the evolution from traditional print to digital dissemination, the article highlights OAP's transformative impact on scholarly communication. Emphasizing the benefits of unrestricted access to scientific literature, the paper looks into diverse OAP models and examines supporting policies from political and academic bodies. The challenges such as article processing charges (APCs), potential erosion of peer-review credibility, and the proliferation of predatory journals are also addressed. The paper suggests that questions on future sustainability and dominance of OA scholarly publishing models still remain open.

Keywords:

scholarly communication, open access publishing, article processing charges (APCs), peer-review credibility, predatory journals

Sažetak:

Otvoreni pristup u medicini: mogućnosti i prijepori

Rad daje pregled objavljivanja znanstvenih radova u otvorenom pristupu (OAP) u području medicine, prateći prijelaz s tradicionalnog tiskanog na digitalno objavljivanje. Članak naglašava transformativni utjecaj OAP-a na znanstvenu komunikaciju, izdvaja prednosti neometanog i slobodnog pristupa znanstvenoj literaturi te razmatra različite modele OAP-a i politiku potpore koju otvorenom pristupu pružaju politička tijela i akademske ustanove. U članku se opisuju i izazovi OAP-a, kao što su naknade za obradu članaka (APC), potencijalna erozija kredibiliteta recenzijskog postupka i proliferacija predatorskih časopisa. Zaključci sugeriraju da pitanja o budućoj održivosti i prevlasti modela znanstvenog objavljivanja u otvorenom pristupu još uvijek ostaju otvorena.

Ključne riječi:

znanstvena komunikacija, objavljivanje u otvorenom pristupu, naknade za objavu članaka, kredibilitet recenzijskog postupka, predatorski časopisi

Introduction

The shift from conventional print communications to digital online dissemination was one of pivotal moments in the evolution of academic publishing. It brought profound changes, enabling restructuring of traditional models of scientific communication, and preparing the scientific community for the new paradigm. The emergence of open access publishing (OAP) played a key role in this evolution, introducing new publishing methods, revised access approaches, and increased public availability of scientific information. OAP represents a remarkable development in scholarly communication, contributing to a more accessible and collaborative scientific landscape.

A conference in Budapest (1) resulting in Budapest Open Access Initiative (BOAI), as well as the Bethesda Statement on Open Access (2) and Berlin Declaration on Open Access (3) that followed shortly after, marked the advent of new era in scholarly publishing aimed to achieve two major goals: the elimination of paywalls for articles published in peer-reviewed journals, thus making research results widely accessible without cost to readers, and a significant reduction in overall publishing and access costs for researchers, their institutions, and funding agencies, particularly the increasingly costs of major journal subscriptions for institutional libraries (4).

Over the course of two decades following the public announcement of those goals, the OA movement has gained strength, leading to a rise in the number of OA journals and development of various OAP outlets. However, this growth is accompanied with controversies that challenge its core principles.

The objective of this paper is to outline the evolution of open access publishing (OAP), with a particular focus on the field of medicine, and to highlight certain controversial issues addressed in recent medical literature.

Open access publishing (OAP)

According to Aronson (5) the phrase "open access" to scientific data, including gene sequence data, was first mentioned in the 1990s. The earliest reference to free online access to published articles in journals occurred in 2001, in the Budapest Open Access Initiative (BOAI). BOAI defines open access to peer-reviewed journal literature as "its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited" (1). BOAI recommends two complementary strategies, authors self-archiving their papers in open archives and a new generation of open-access journals.

The Bethesda Statement on Open Access Publishing was issued in April 2003 as a result of a meeting held at Howard Hughes Medical Institute. It defines open access publication as one which grants a "free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit, and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship" and from which every article is "deposited immediately upon initial publication in at least one online repository" (2).

Unrestricted access to scientific literature is the key benefit enabled by OAP, particularly for researchers in low-income countries. Beyond this, OAP accelerates the publication process, ensuring rapid dissemination of research. It amplifies the visibility and impact of publications, fostering a more interconnected global scientific community. Importantly, OAP contributes to building trust in science by promoting transparency and openness, and enhancing collaboration on an international scale (6).

OAP models

Contemporary scientific journals' publishing models include traditional subscription model, where access is paywalled (in order to read the paper scientist or their institutions have to pay a subscription), open access model, where all journals' content is free to readers, but the publisher may charge authors for article processing costs, and the hybrid model (subscription model with an open-access choice available).

Open access to scientific publications can be achieved through:

- Publishing in OA journals ("gold OA") or choosing the OA option in hybrid journals, providing immediate and unrestricted access to all content. These journals are registered in Directory of Open Access Journals (DOAJ), and the publishers usually charge article-processing fees (APCs) from the author. A worthy exception are so called Diamond/Platinum journals, which offer free and unrestricted access without charging either readers or authors.
- Self-archiving ("green OA") in which authors share a publisher-allowed version of their paper (submitted, accepted or published) by posting it in an institutional or subject repository, personal web pages and/or social media profile. Publishers usually apply embargo period (in STEM disciplines six to twelve months).
- Preprinting in which authors make their work public prior to official journal publication by sharing research results in the form of a preprint. A preprint is a version of a scientific manuscript posted on a public server prior to formal peer review, providing rapid feedback and dissemination of the results. With the surge of post-pandemic preprinting, journals are beginning to allow and even encourage its use (7).

Support to OA policy

During the last decade, increasing number of research institutions, international organizations, political entities, and funding bodies adopted the OA principles, proclaiming mandatory OA to scientific outputs resulting from publicly funded research. The recent document of the Council of the European Union (May, 2023) „RECALLS that scholarly publishing, through journals, is currently the primary academic means of disseminating research results and new scientific knowledge“, „HIGHLIGHTS that immediate and unrestricted open access should be the norm in publishing research involving public funds“ and „REITERATES the importance of accelerating the transition to open science to improve research quality, efficiency and impact by promoting transparency, accessibility, diversity, reusability, reproducibility and trustworthiness of research results, that open access to scholarly publications, including their reuse, is one of the core elements of an open science system (8).

In 2022, the US Office of Science and Technology Policy (OSTP) updated its previously existing OA policy (9) recommending that all federal agencies should adjust their public access policies as soon as possible, and no later than the end of 2025. The goal is „to make publications and their supporting data resulting from federally funded research publicly accessible without an embargo on their free and public release” (10).

In the communique issued in May 2023, G7 Science and Technology Ministers recognized that „openness, freedom, and inclusiveness should be enhanced globally for the sound development of scientific research” and that they will „collaborate in expanding open science with equitable dissemination of scientific knowledge and publicly funded research outputs including research data and scholarly publications in line with the Findable, Accessible, Interoperable, and Reusable (FAIR) principles“ (11).

OA in Croatia

Croatia still does not have an official OA policy, but the e-infrastructure that makes it possible is financed by state funds. This primarily refers to the Hrčak platform (12), which provides free access to articles published in Croatian professional and scientific journals, and Dabar, a nation-wide system of institutional digital repositories (13). Both infrastructures are open to journals, institutions and authors free of charge.

OAP in medicine

Initiatives aimed at enabling wider and faster access to medical information gained momentum in the early 1980s. At that time the US National Library of Medicine (NLM) had already been experimenting with the application of emerging technology to facilitate access to medical information. However, two key developments at the end of the century have permanently changed access to medical information. In 1996, NLM launched the Internet based PubMed, a free search engine accessing primarily the MEDLINE database of references and abstracts from biomedical journals (14). Then came PubMed Central (PMC), freely available online since 2000. Both resources are developed and maintained by the National Center for Biotechnology Information (NCBI) at NLM. Harold Varmus, Nobel Prize winner and then director of the US National Institutes of Health (NIH), said that he „was convinced that a radical restructuring of methods for publishing, transmitting, storing, and using biomedical research reports might be possible and beneficial” (15).

From comprising only two journals, *PNAS: Proceedings of the National Academy of Sciences* and *Molecular Biology of the Cell*, PMC has grown to an archive of articles from thousands of journals. Recently, PMC started to include authors' manuscripts deposited because of the research funding bodies' OA mandates, and preprints collected through the NIH Preprint Pilot (16).

In early 2000s, two big publishers of open access medical journals, Public Library of Science (PLOS) and Biomed Central (BMC), entered the publication arena, and the boom of OA publication models started around the year 2003. Today, in the field of (bio)medicine more than 60% of published papers are freely available. Figure 1 illustrates the annual growth of number of papers indexed in PubMed, emphasizing the escalating share of OA papers over time. Out of 1.774.478 papers published in 2022 and accessible at the PubMed platform, 1.063.183 are readily accessible as free full texts. In the same year, the percentage of OA among PubMed-indexed papers from Croatia exceeded 70%.

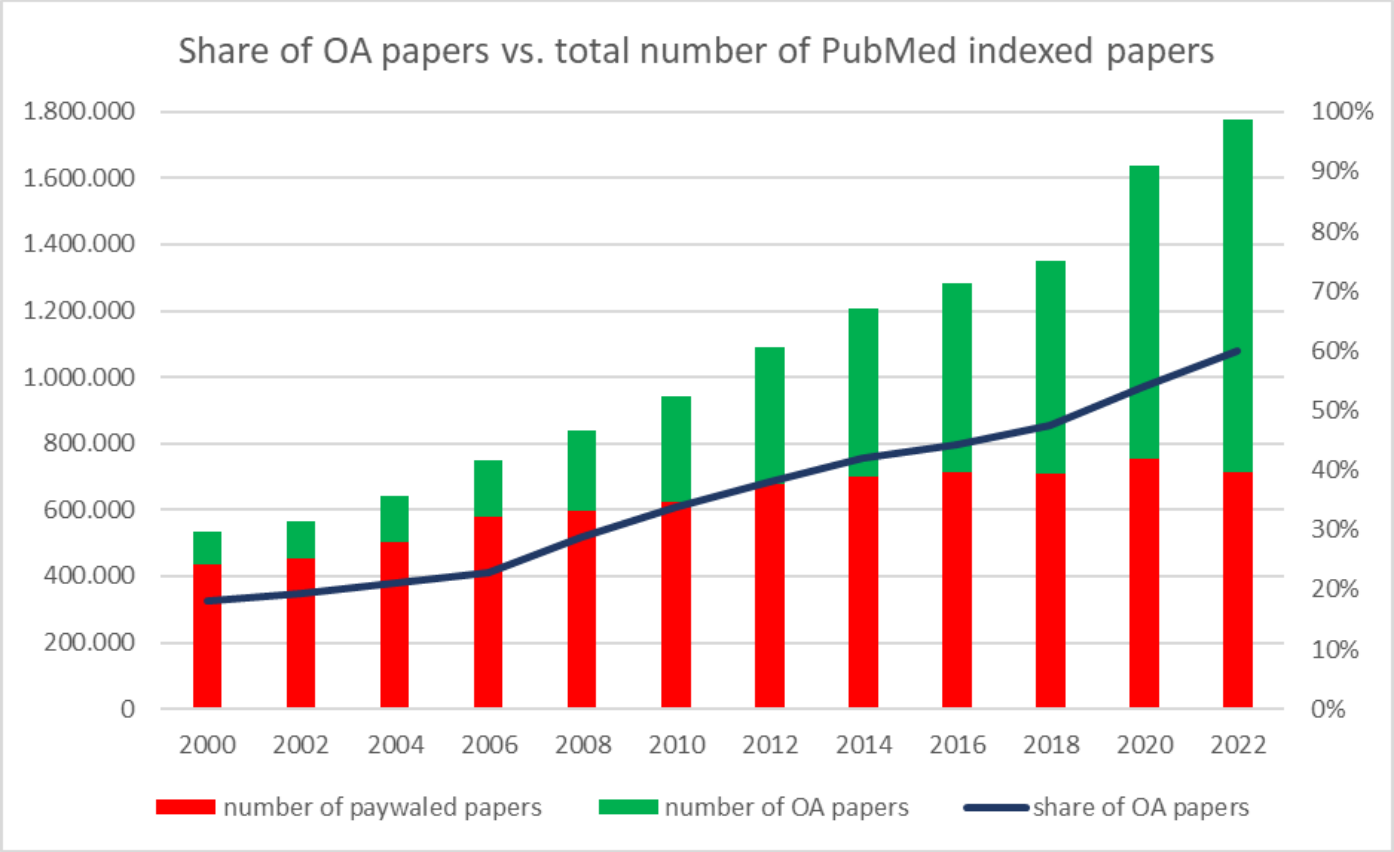

Figure 1. Share of OA papers vs. total number of PubMed indexed papers

There are numerous reasons explaining the upsurge of open access in the field of biomedicine. The OA principles in fact coincide with the main principles of access to health information. For example, the Healthcare Information For All (HIFA), a global campaign working closely with World Health Organization to improve the availability and use of reliable healthcare information worldwide, proclaimed a vision of „a world where every person and every health worker has access to the reliable healthcare information they need to protect their own health and the health of others, and is protected from misinformation" (17). Moreover, in 2019 the World Medical Association (WMA) adopted the *Statement on healthcare information for all* proclaiming that „Access to relevant, reliable, unbiased, up-to-date and evidence-based healthcare information is crucial for the public, patients and health personnel for every aspect of health, including (but not limited to) health education, informed choice, professional development, safety and efficacy of health services, and public health policy" (18).

The coronavirus disease (COVID-19) pandemic vividly demonstrated the power of open science, as publishers and journals decided to make COVID-19-related research freely accessible to all. Immediate free access to research publications and data clearly provided benefits to scientific discourse and public health policies. That is why the G7 Science and Technology Ministers' Comunique explicitly acknowledged that open science platforms should enable early development and more rapid, effective, and equitable access to medical countermeasures for the prevention and control of emerging and re-emerging infectious diseases. (11). OA benefits are not limited to the scientific and medical community alone; it "creates an opportunity for improving patient education, advocacy, and shared decision-making", discouraging patients from seeking information from less reliable sources (19).

Sharing research/scientific data, defined as data meeting quality standards for validating and replicating research findings, plays a crucial role in efficient resource utilization. By fostering scientific collaboration, and aiding decision-making in healthcare, this practice enhances transparency, allowing external researchers to reanalyze, synthesize, replicate and build upon existing evidence (20).

Clinical trial data sharing is particularly emphasized by the International Committee of Medical Journal Editors. Its new Recommendations require that manuscripts reporting the results of clinical trials must contain a data sharing statement, addressing various aspects such as the nature, timing, and criteria for sharing (21). Despite challenges, experiences during the COVID-19 pandemic have shown encouraging progress in medical data sharing (22).

Challenges facing open access publishing

Despite evident advantages of OA for biomedical research and clinical practice, recently published medical papers have highlighted several dilemmas. These challenges primarily include concerns related to article processing charges (APC), the potential erosion of the peer-review process's credibility, proliferation of publications and scientific journals, and the rise of predatory journals.

Article processing charges (APCs)

Article processing charges (APCs) are fees paid by authors of scholarly articles. They are used by open access journal publishers as a substitute for subscription fees that libraries and readers traditionally paid to gain access to articles. In this widespread business model, APCs shift the burden of journal production costs (editing, peer review, hosting, archiving, preservation), from readers to authors.

From todays' perspective, it seems that the second goal of OA movement – reduced total costs of publication to the research community – had not been achieved. Moreover, in an essay published in NEJM, Haug shows that the total costs of publishing are actually increasing (23). According to Fernández Pinto, the implementation of open science principles has in fact contributed to the commercialization of research (24).

Journal APCs vary, typically depending on factors such as the publisher's size, the proportion of papers sent for peer review and metrics such as impact factor, etc. (25). According to Morrison et al. the global average of APC per article increased over the past few years from $904 to $1.626. (26), while Crawford reported the average cost per article in DOAJ journals in 2021 was US $1.997 (27). However, APCs differ depending on the field of research. Vervoort et al. concluded that medical journals charge the highest APCs among academic disciplines, and that the fees are prohibitive for unfunded and lesser-funded researchers (28). For instance, Lancet provides an OA option for $6,830 and BMJ for $6,950.

Koong et al. studied publication costs in oncology journals and found that hybrid journals tended to have significantly higher OA publication fees compared to their full OA counterparts (19). Since hybrid journals allow both subscription-based publishing (not OA, no APCs to publish) and an OA option (freely accessible for readers, but APCs to publish), only authors with special interest in having their articles published in OA, and those willing and able to pay the APC choose the OA option. To date, majority of medical journals remain hybrid. For example, in cardiology and cardiac surgery, 60.9% of journals are hybrid (28).

Protests by editors of scientific journals against excessively high APCs imposed by publishers have strongly resonated within the scientific community. More than 40 editors recently resigned from two leading neuroscience journals arguing that the publishing fees are unethical (25). The editors of one of Wiley's journal have done the same (29).

Still, APCs remain a crucial problem for many young authors, institutions and even certain countries (4), creating financial barriers for researchers and potentially influencing the direction of published research.

Compromised credibility of the peer-review process

The peer-review process in medicine is of utmost importance. Scientific rigor and the meticulous evaluation of scientific results before their publication are critical components for integrating new knowledge to our understanding and treatment of diseases (30). Besides, publishing biomedical papers without rigorous peer review can have severe negative consequences on patients and clinical outcomes (31).

For established journals and their editors, the peer-review process serves as the primary tool for determining the acceptance or rejection of articles. A high-quality review not only aids editors but is also crucial for authors, helping them address weaknesses in their manuscripts (31). However, the advent of new publishing outlets such as preprints, mega-journals, cascade journals, and profit-oriented journals has raised concerns about the credibility of the assessment process. In response, experts like Frank J et al. argue for reinforcing peer review rather than bypassing it entirely. The authors assert that while increased reliance on self-archiving and preprint publication can be beneficial, robust peer review remains indispensable, particularly in health research (4). The need for swift dissemination of knowledge should not compromise the integrity of the peer-review process.

Moreover, the surge in the number of published primary studies has made the systematic review process more inefficient. Thousands of papers now undergo a relevance test, leading to the identification of only a small fraction of reasonable quality (4). Given that systematic reviews play a critical role in shaping new research priorities, especially in clinical medicine, the inadequacies in the peer-reviewing of primary studies may have far-reaching implications on health outcomes. Therefore, upholding the integrity of the peer-review process remains pivotal for the advancement of medical knowledge and the improvement of healthcare practices.

Predatory journals

The proliferation of publications and journals, facilitated by the ease of online dissemination, is causing an overwhelming information overload (see Fig 1). This phenomenon dilutes the quality and significance of scientific contributions, paving the way for the emergence of so-called predatory journals.

In 2019, a group of scholars (many of them from the field of clinical medicine) reached a consensus defining predatory journals and publishers as "entities that prioritize self-interest at the expense of scholarship" characterized by "false or misleading information, deviation from best editorial and publication practices, a lack of transparency, and/or the use of aggressive and indiscriminate solicitation practices" (32). Rupp et al. noted that „predatory journals promise everything a scientist would like to see: secure publication within a short period of time managed by a short peer review process and an almost 100% acceptance rate" (31). Moreover, they offer lower article processing fees then the renowned publishers. According to Frank J, et al. „the pressure to publish among the researchers is a quintessential driving force for sustained growth of such journals" (4). In order to advance or receive financial support, researchers and faculty members, especially in scientifically peripheral countries, are frequently required to publish a certain number of papers in internationally visible journals. Some of them turn to predatory journals for publishing papers previously rejected by the other journals. In addition, young and unexperienced authors are more receptive to predatory journals' tactics.

In their study of predatory journals in plastic surgery literature, Assad et al. found that almost half of potentially predatory journals mention rapid publication and shorter review time (three journals reported 3- to 4-week turnaround times). On the other hand, median time from submission to publication in subscription-based plastic surgery journals is 10 months (34).

Boulos et al. showed that predatory journal articles may have started to infiltrate knowledge synthesis in Cochrane reviews. Even though only 0.8% of the evaluated studies were published in potentially predatory journals, the authors pose the question „if even one citation in a systematic review to a predatory journal may be too many" (35).

The future of open access publishing

It is difficult to determine the direction in which the OAP will develop. In May 2023, the Council of the European Union highlighted the importance of not-for-profit OA publishing models, extending support to development of such ventures led by public research organizations. Will this path prevail in the EU countries? The Croatian model where almost all scientific journals are not-for-profit, available in OA, predominantly not charging for article processing, and receiving government subsidies fits into that framework (36).

Despite noble intentions, mandatory publishing in OA proposed by many research funding bodies, and the initiatives like Plan S (37) have contributed to progression of APC-financing publishing models. Today "we face a growing risk that the ability to pay APCs—rather than the merits of the research—will determine what and who gets published." (38).

Will the governments, funders and institutions stop supporting APCs and invest funds currently allocated to APCs in shared infrastructure, tools and services that can support multiple journals simultaneously? (39)

Will diamond open access, following models such as Hrčak and SciELO (40) and promoted by the EU-funded project DIAMAS (41) gain broader acceptance? Could one of the viable solutions involve non-profit scholarly OA publishing platforms and OA repositories?

Major for-profit publishers are unlikely to concede, and the strength and persistence of the scientific community's push for an open, equitable, and sustainable scholarly publishing system will play a crucial role. Could we conclude that open access publishing is becoming the norm in publishing, irrespective whether for-profit journal publishers like it or not?!

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