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LITERATURE REVIEW:

Revisiting Open Science Through a Global Health Lens: Critical Reflections

Reflexiones críticas en torno a la Ciencia Abierta desde la perspectiva de la Salud Global

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ABSTRACT: Open Science has become a global movement promoting accessibility, transparency, and collaboration in research. It encompasses open access, open data, citizen science, and digital innovations, fostering inclusion and public participation, particularly in social and health sciences. This shift challenges traditional scientific models by emphasizing ethical integrity, research transparency, and knowledge co-creation. However, issues like authorship, funding, and scientific misconduct remain critical concerns. Open Science enhances research efficiency, democratizes knowledge, and strengthens institutional impact. This article aims to map current and future Open Science initiatives in global health, providing a systematic framework to support decision-making and scientific adaptation to this evolving landscape.

KEYWORDS: Open science; Access to information; Global health; Interdisciplinary research; Citizen science; Global health.

RESUMEN: La Ciencia Abierta se ha consolidado como un movimiento global que promueve la accesibilidad, la transparencia y la colaboración en la investigación sanitaria. Abarca el acceso abierto, los datos abiertos, la ciencia ciudadana y las innovaciones digitales, fomentando la inclusión y la participación pública, particularmente en las ciencias sociales y de la salud. Este giro desafía los modelos científicos tradicionales al enfatizar la integridad ética, la transparencia en la investigación y la co-creación de conocimiento. No obstante, cuestiones como la autoría, el financiamiento y las malas conductas científicas continúan siendo preocupaciones críticas. La Ciencia Abierta potencia la eficiencia investigativa en salud, democratiza el conocimiento y fortalece el impacto institucional. Este artículo tiene como objetivo

mapear las iniciativas actuales y futuras de Ciencia Abierta en el campo de la salud global, ofreciendo un marco sistemático que apoye la toma de decisiones y la adaptación científica frente a este panorama en constante evolución.

PALABRAS CLAVE: Ciencia abierta; Acceso a la información; Salud global; Investigación interdisciplinaria; Ciencia ciudadana.

INTRODUCTION

Open Science has evolved into a contemporary reality, transcending the realm of mere possibility to become a global movement that demands critical and strategic adoption by research centers and institutes within academic institutions (1). Broadly speaking, the objective of this movement is to enhance accessibility of scientific research for individuals across diverse backgrounds, including other scientists, citizens, decision-makers, and public policy makers.

This issue has emerged as a strategic concern in some nations and has been propelled by the endeavors of science and technology. The macro-concept of Open Science, a prevalent notion within the field, encompasses a myriad of concepts, including open access, open data, citizen science, open peer review, open source, open educational resources, and scientific social networks.

It is important to note that this concept is characterized by public participation in data collection and analysis, local and individual knowledge in various areas, mainly in strategic areas such as the social sciences and health sciences (2). In this context, the incorporation of new information and communication technologies in the context of contemporary scientific research and publication can be understood as a response to several challenges, including the need to address ethical considerations in the face of rapidly advancing technologies.

This paradigm shift has given rise to novel designs that facilitate cooperative endeavors that contribute to the expansion of Open Science (3). The development of networked societies and the production of knowledge-deeply embedded within the dynamics of cognitive capitalism-have precipitated a fundamental rupture in the traditional scientific system.

In this context, the open science movement emerged as a catalyst for discourse on the conventional model of scientific communication, emphasizing the principles of collective construction of knowledge, openness and socialization of information, the reward system, and the validation of innovations.

Concurrently, other challenges have emerged within the contemporary cycle of scientific research and publication, which underscore the necessity for Open Science, particularly in relation to ethical considerations (4). These ethical considerations, which pertain to attributes such as unpublishability, authenticity, authorship, funding, exceptions, methodology, relevance, and applicability, are of paramount importance in determining the credibility of research. In light of these concerns, it is imperative to emphasize the fundamental principles of ethics and integrity that underpin the scientific endeavor.

Therefore, the need for transparency in the research process, the capacity for monitoring and

replication, and the intrinsic value of scientific inquiry become fundamental. This is critical given the widely recognized consequences of ethical misconduct in research-such as fraud, falsification, and plagiarism-which can lead to profound challenges and undermine the integrity of scientific advancement.

Illustrative cases of this include biased or altered results, damage to reputation, loss of academic credentials, the omission of study variables based on current financial interests, methodologies that do not align with research objectives, the arbitrary approval of certain projects at the expense of others, and other similar instances. In this regard, there is an imperative for comprehensive access to the research record, extending beyond the published article that is the hallmark of the Open Science movement.

This movement highlights the potential for researchers to engage in collaborative efforts, thus fostering a paradigm of co-creation and knowledge socialization between the scientific community and society at large. This approach not only expands the recognition of scientific contributions, but also strengthens research integrity, promoting greater transparency and accountability in the dissemination of knowledge.

Considering the numerous challenges stemming from the opacity of scientific processes, the Open Science movement has emerged as a response, with the objective of enhancing scientific rigor, efficiency in research, and the expansion of knowledge. This approach not only accelerates the creation of new topics of study, but also fosters the growth of scientific return for institutions. Furthermore, it promotes the valorization and protection of intellectual property, thereby contributing to the social impact and economic value of science.

Open Science methodologies are conceptualized from the perspective of democratizing the utilization, access, and reproduction of scientific knowledge. These approaches even propose social inclusion and participation in scientific construction. Accordingly, from a geopolitical perspective, Open Science can be regarded as a method of knowledge production.

The Open Science approach fosters the inclusion of communities, as well as historical and social dimensions that have traditionally been marginalized in scientific production. These evolving global cooperative frameworks facilitate shared responsibility and accountability across research, the social sciences, and health, reinforcing a more inclusive and ethically grounded knowledge production process.

In light of the aforementioned considerations, this article aims to map research initiatives, actions, and methodologies within the domain of global health that are aligned with the principles of Open Science. The manuscript is of particular relevance for two reasons: first, it addresses a timely and critical topic, and second, it provides a systematic framework for analysis to support decision-making. This framework is essential for scientists seeking to adapt to the evolving paradigm, where creation, exchange, sharing, and collaboration are integral to scientific advancement across all academic disciplines.

PARADIGMATIC REFLECTIONS ON OPEN SCIENCE

The Open Science movement was initially driven by the movement for open access to scientific publications, which emerged in the late 20th century in reaction to the high prices imposed by commercial publishers. This period coincided with the tightening of intellectual property protection regimes and the privatization of knowledge (5).

It is also noteworthy that the present discourse originates in the open access movement, which emerged in the context of the Internet's advent,

leading to the development of original digital platforms that promoted the dissemination and socialization of knowledge and the augmentation of access to research.

Since then, Open Science has undergone constant evolution and has been organized within five schools of thought. The first school is the public school, which advocates for making knowledge accessible to the public through Web 2.0. The second school is the democratic school, which promotes equal access and focuses on free access. The third school is the pragmatic school, which approaches the scientific process modularly. The fourth school is infrastructural, which emphasizes the necessary structure for conducting research and is oriented towards software and support networks. The fifth school is the school of measurement, which addresses the impact achieved by open initiatives through metrics (6).

The Open Science movement signifies the potential for local production and the establishment of publication channels that are more accessible and competitive with those promoted by countries that have demonstrated significant progress in this domain. A salient factor in this context is the development of institutional repositories for the archiving of scientific output, the construction of regional databases, and the establishment of open-access scientific journal portals to facilitate system-wide organization.

The advancement of scientific knowledge is contingent on a collective commitment to transparency, collaboration, and the extensive dissemination of discoveries. In this context, Open Science has emerged as an essential paradigm for democratizing access to information, thereby enabling researchers from diverse global regions to share their findings and contribute to significant advances in various domains of knowledge. This approach not only reinforces academic credibility, but also fosters a more egalitarian and empowered society, better equipped to address contemporary challenges.

The growing demand for publications in prestigious academic journals underscores the need for higher education institutions to intensify their efforts in cultivating researchers capable of producing knowledge relevant to the contemporary era (7). The consistent publication of scholarly work by educators is crucial for strengthening national academic output while simultaneously enhancing the global influence of research endeavors. This, in turn, positions them within the context of an increasingly interconnected global landscape.

However, the training of new researchers should extend beyond the confines of the classroom or laboratory. It is imperative that academic institutions foster scientific initiation from the early stages of undergraduate education, creating environments that promote research and critical thinking.

Providing qualified mentorship and strengthening postgraduate programs are key measures to ensure the continuity and quality of global research efforts (8). Scientific publication must be viewed as a dynamic and accessible process, where principles such as peer review, data transparency, and broad dissemination of results take precedence. In this regard, academic journals play an essential role in facilitating spaces for the discussion and validation of knowledge, thereby ensuring the credibility and relevance of the research published.

As is known, Open Science, as a movement, encompasses other equally important initiatives, which can be called Open Science ecosystem initiatives. The concept of ecosystem in this context draws parallels with the ecosystem as

understood in the biological realm, deriving from the Greek term "ooikos" (house) and "systema" (where one lives).

This notion corresponds to the ecosystem concept, which necessitates a set or process of relationships that establish interactions or interdependencies within an interactive community in its environment. It is imperative to acknowledge that the ecosystem of open science constitutes a network of systems, initiatives, and dimensions, intricately woven within the milieu of knowledge creation and scientific communication. These elements are interconnected, exerting a profound influence on other systems within the larger context.

Therefore, it can be understood that this ecosystem is classified into distinct categories based on its particularities: a) philosophical, encompassing ethics, integrity, and transparency; b) scientific, which includes innovation, use, reuse, reproducibility, and replicability; c) social, incorporating the concepts of collaborative networks, citizen science, socialization, and the democratization of information; d) technological, addressing standardization, traceability, and interoperability; e) policy, focusing on the development of legislation and public policies to promote open science; and f) economic, involving investment, scientific communication infrastructure, and strategic negotiations on access to information among countries (9).

The emerging concept of the Open Science ecosystem underscores the necessity for a global dialogue, as the objectives of enhancing transparency, collaboration, and equity may, at times, be at odds with one another in terms of their philosophies, policies, and practices. Consequently, reform in science ought to encompass the research system on a global scale, as opposed to pursuing policies based on countries or regions.

Instead, we propose emphasizing recommendations from entities such as UNESCO, as a preliminary measure, along with the utilization of shared infrastructures among nations. We contend that open science necessitates a robust structural foundation, financial resources, knowledge, and motivation to facilitate progress in the field. Merely opening processes is insufficient for ensuring reuse and fostering scientific collaboration (10).

In this context, "open" is understood as an academic platform for science that leverages digital tools in research processes, facilitating the reduction of labor divisions. Open projects, for example, exemplify this approach. However, it is crucial that those engaged in Open Science ensure that the fragmentation of processes does not inadvertently foster ideologies that could be detrimental to the broader community.

Specifically, it is imperative to identify additional elements that influence a journal. One such response, related to data access and conditions for research reproduction and replication, was the development of guidelines found in the Transparency and Openness Promotion (TOP) for journals. These guidelines set out instructions for strengthening the editorial process of an article within a research life cycle.

These guidelines are distributed across eight key elements designed to enhance consistency and transparency in academic journals. These elements cover citations, data transparency, transparency of analytical methods, research materials, project and analysis transparency, pre-registration of studies and analysis plans, and replication-critical for confirming the reproducibility of results obtained in prior research.

Given these considerations, it is imperative that both data and methods are transparent, with

replication actively encouraged and supported by researchers and the broader scientific community. Achieving this requires the establishment of a new global pact, which is essential for addressing the pressing challenges our planet faces. Such a pact would help counteract the imbalance created by the private appropriation and distribution of scientific knowledge, particularly in strategic areas like health, the environment, and social justice.

In the context of fostering public participation in research, health, and social justice, a novel form of political construction has emerged since 1990, characterized by collective problem-solving at the global level (11). This emerging politics is predicated on the adoption of new ethical and moral values, a necessity precipitated by the persistent discrediting and criticism directed at institutions, including science.

The issue of collective learning and the production of knowledge has been a subject of constant study within the domain of the Social Sciences. Within the context of health, the role of community involvement has emerged as a pivotal point of discussion since the Alma-Ata Declaration in 1978, which underscores this element as a central catalyst for enhancing health services, planning, and policies.

The integration of these concepts into the paradigm of Open Science has precipitated substantial transformations, particularly with respect to the modus operandi surrounding the formation of collaborative networks for addressing global challenges in strategic domains. The routine engendered by these elements has given rise to unusual social, economic, and political relationships, thereby establishing a paradigm of rupture that has given rise to new ethical models wherein information and knowledge assume a key role.

Among the factors that stimulate this, we can mention the sharing of scientific data and information, expertise and competences, the change of capabilities, the achievement of greater prestige and visibility in the scientific community, the progress in the resolution of major global problems such as research related to DNA, epidemics, pandemics such as Zika, Ebola, and COVD-19, the identification and resolution of failures in the most efficient and fastest way, among others (11).

Moreover, the implementation of these measures has been further encouraged by transnational health bodies, governments, and institutions. With respect to the global health crises, international health regulations have been established, including legal mechanisms endorsed by member countries of the World Health Organization. The main objective of these mechanisms is to facilitate a coordinated public health response to diseases with the potential for global propagation.

In the event of a public health emergency of international importance being declared, member countries of this regulation (or, more technically, international health) are obligated to respond promptly by establishing a global action to identify a collective resolution. To this end, collaborative networks with a broad capacity are established, trans-informational, involving international organizations such as the United Nations Organization (UN), the World Health Organization (WHO), and the World Trade Organization (WTO), with the objective of addressing urgent situations. It is within times of need for a prompt scientific response that research becomes increasingly open, interdisciplinary, transdisciplinary, and public (12).

Collaborative studies and networks maintain a close relationship, wherein transdisciplinary

models for knowledge production converge, fostering an understanding of how the ecosystem's various entities cooperate and symbiotically utilize their resources to generate new scientific practices that validate their actions, knowledge, and innovations.

Consequently, it is imperative to broaden the discourse on the role of academia in promoting the dissemination of knowledge and the support of Open Science globally. Such efforts contribute to the inclusion of society in the defense of the scientific community and policies promoting equity, which help to shape the Open Science movement.

The implementation of Open Science brings a range of challenges, with cultural resistance being one of the most significant barriers. Many researchers are accustomed to a system that places value on positive results and publications in high-impact journals. These beliefs can impede the adoption of open practices.

Additionally, concerns regarding intellectual property and the potential misuse of openly shared data are valid and need to be carefully addressed. Ensuring a balance between protecting researchers' rights and promoting transparency is a nuanced task that demands thoughtful management.

Another major challenge involves the need for a robust technological infrastructure to facilitate Open Science, including data repositories, pre-registration platforms, and transparent analysis tools. This necessitates considerable investment in both technology and training.

Without sufficient institutional and financial support, researchers may face difficulties in fully embracing these open practices. Furthermore, the transition to Open Science requires a fundamental re-evaluation of academic incentives. The prevailing reward systems in academia often prioritize the quantity of publications and the immediate impact of results, rather than emphasizing the quality and long-term reproducibility of research.

In this regard, editors of high-impact journals play a crucial role in driving change. As key influencers of publication standards, they bear some of the responsibility of prioritizing transparency and reproducibility and leading efforts to establish new editorial practices that emphasize scientific integrity. The implementation of policies such as pre-registration, open data publication, and the acceptance of negative results in prominent journals would not only incentivize researchers to adopt more rigorous practices, but also serve as a model for other scientific journals.

This could serve to foster a broader cultural transformation within the academic system. We would like to emphasize the importance of disclosing negative results to enhance transparency and reproducibility in scientific research. As academics, we can promote critical discussions on replicability, transparency, and pave the way for a more comprehensive approach to scientific inquiry.

Educating researchers in Open Science practices and statistical literacy represents a considerable investment of resources and time. Nonetheless, by fostering a culture of transparency and collaboration, Open Science practices have the potential of revolutionizing research, thus enhancing the integrity and reliability of scientific results.

For this transformation to occur, a collective effort is required from the scientific community, research institutions, funding agencies, and scientific journals. This shared commitment is essential to ensure the widespread adoption of Open Science principles and to strengthen the foundations of scientific knowledge.

CONCLUSION

In conclusion, it is important to note that since 1990, the modeling of the scientific production process has become increasingly open to public participation. This shift is largely due to the advancements in information and communication technologies, which have facilitated access to and reuse of research data, as well as increased social participation. Consequently, new scientific methods are likely to be developed.

In light of these developments, this reflection proposes an examination of strategies and guidelines within academic institutions that have been identified as part of the Open Science movement. The pressing global public health challenges posed by epidemics and pandemics, such as those experienced with Zika, Ebola, and SARS-CoV-2, underscore the necessity for novel cooperative arrangements that entail shared responsibility and alternative models of accountability to society.

As is common in periods of transition, it is important to address various barriers, including informational disparities between the public and researchers, as well as inherent shifts within the scientific ecosystem. While more progress is needed to improve scientific practices and ensure public engagement in research, it is clear that the active involvement of citizens, public and private organizations, and policymakers is crucial for ensuring the social sustainability of science.

The implementation of the dimensions of Open Science in journals reveals not only the challenges related to editorial training, but also the systemic problem within the academic ecosystem. This global problem includes the evaluation of scientific production (i.e., the reward and funding system), the training of researchers (including their roles as evaluators, editors, and authors), as well as scientific communication.

Overcoming these barriers requires systemic actions that permeate the entire scientific research cycle. It is imperative to closely monitor the practices adopted to ensure that the structure of openness is genuinely advantageous and contributes to the reduction of current barriers and privileges.

While it is evident that technological tools are undergoing substantial advancement, the transition process appears to be marked by an element of sluggishness. An urgent need exists to institute integrative policies at various hierarchical levels to facilitate the implementation of Open Science policies and practices in a systematic, coordinated and collaborative manner.

Finally, the integration of Open Science practices within the scientific research process holds the potential to effect a grand transformation in the field, and promote greater transparency, collaboration and reliability. To overcome cultural and technological challenges for Open Science within the scientific community, it is essential for research institutions, funding agencies, and scientific journals to make a concerted effort to change.

The successful implementation of new Open Science practices will not only increase the integrity and reliability of scientific results, but will also benefit society, by promoting a more ethical and robust advancement of scientific knowledge.

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