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## Open Science in Pandemic Times: A Literature Review

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### Abstract

In late 2019, a new SARS-Cov-2 class virus originally appeared in the city of Wuhan in China. It quickly spread through human contact, reaching more than 100,000 confirmed daily cases worldwide by the end of May 2020. The results of some previous outbreaks have revealed that data sharing is critical in the effectiveness of its treatment, as well as in early warnings of future crises. In this sense, this literature review article aims to identify open approaches and their advantages and disadvantages in the context of health emergencies. Thus, an overview of the impact of Open Science for the current pandemic is presented, leaving open questions and suggestions for future work.

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### 1. Introduction

Nowadays, the need to acquire knowledge through technological resources is increasing for various purposes. The health sector is one of the fields that lacks the most in adoption and innovation of technological resources. This trend has grown exponentially in this domain, especially during the most recently world-wide phenomenon caused by the novel Coronavirus (Covid-19), of the SARS-CoV-2 class [1].

This endemic virus that originated a pandemic declared by the World Health Organization (WHO), mobilized the lives of the world population. Protection and social isolation measures were taken into consideration, while the health system was preparing for a great battle.

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Predicting the behavior of society and the conduct of healthcare facilities in this health crisis has become an arduous and complex task. The development of evidence-based research and studies was crucial in this context. Several disciplines contributed to the faced biological threat, including the technology branch, standing out as a pioneer to achieve the desired success [2].

Lately, data sharing, as well as the Open Science movement, have been a trend topic present in information systems research. The times we live in motivated us to combine this subject with the healthcare domain [3]. In this sense, this paper aims to establish an overview about Open Science adoption in critical times.

The article is structured in four sections. First, an introduction to the topic of study is presented. Secondly, a background on Open Science and its concepts is established. The third section presents an overview about pros and cons of Open Science approach. At last, in section four, conclusions and opinions are drawn in order to strengthen the discussion about the matter.

## **2. Groundwork**

### *2.1. Open Science*

According to [4], Open Science is the “movement to make scientific research, data and dissemination accessible to all levels of an inquiring society”. Its focus covers knowledge sharing by providing transparency, reliability, reproducibility, and cooperation. Building a community of exchanging and sharing of knowledge between society, brings a new idea of a collaborative research around the world [5].

There are several practices and principles related to Open Science. One of the main principles linked to the ‘open’ concept it is to allow free use, without any restriction or cost associated [6]. Regarding Open Science practices, among several components of its taxonomy, I am going to highlight three of them: The Open Data practice is described as “data that can be used in a freeway, shared and built for anyone, anywhere and to everything”. In other words, data that can be used by anyone without technical or legal restrictions [6]; The Open Access term was recently formulated and refers to “free availability of scientific literature on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles” [5]; The Open Source aims to afford full source code to the use and development of any software, providing free redistribution under an open license [5].

### *2.2. A practical point of view*

A study from Nature about the Ebola outbreak in 2014, emphasizes the importance of sharing data in an open way. The authors in [7] exposed an episode of the Ebola epidemic where researchers in the domain contributed to decrease the impact of the outbreak by distributing their data. That effect was only possible because researchers who worked essentially for this purpose, shared data from infected patients (particularly genetic sequences) in public repositories, and, in a short period, received responses from researcher from different countries who helped them to speed up the treatment of the disease and save months of work [7].

Other outbreaks and epidemic crisis were also a big incentive to Open Science. One example is the Zika epidemic responsible for a major outbreak between 2015 and 2016. In this case, all Zika-related data was put free to access; papers were motivated to be published; and public repositories were also available. According to [8], the integration of Open Science approaches in healthcare emergencies is fundamental to their effectiveness. The authors approve the knowledge sharing carried out in the Ebola and Zika outbreaks and also advise the adoption of ‘open’ strategies for future epidemics, as “the cause and context are unknowable; research that seems routine now may be critical tomorrow” [8].

## **3. Formalizing the subject**

The current outbreak caused by the novel Covid-19 virus has provoked a socio-economic impact worldwide with a high transmission rate spread through human contact. In order to build solid knowledge in health emergency

situations, it is necessary to gather and aggregate a lot of information from different sources [9]. This is at the heart of Open Science approach.

UNESCO [10] has been one of the pioneers in promoting Open Science movement. It states that science must relate to societal needs, as well as in facing socioeconomic challenges. In this sense, the Covid-19 pandemic raises the importance of science and its sharing as an “opening of the gates of knowledge” [10].

Therefore, to align the current health crisis with the Open Science movement, possible benefits and concerns have been identified based on the literature re-view. These strands are associated with the three open practices highlighted above.

Table 1. Open Science impact overview

Impact	Description	Approach
Concerns	Social, legal and economic aspects	All
	Privacy and ethical issues	Open Data; Open Access
	Data reliability	Open Data
	Fear of granting a competitive advantage	Open Access; Open Source
	Lack of resources	Open Source
	Legal restrictions internationally	All
Motivations	Promote an integrated research community	Open Access; Open Data
	Clinical decision support	All
	Insights exchange (give and gain)	All
	Personal impacts	All
	Transparency	All

The Open Science overview shown in Table 1 represents the gathering information of literature review on the pros and cons on open approach in healthcare emergencies. There are great motivations when it comes to sharing knowledge, promoting the exchange of ideas, creating a cultural environment and contributing to a rapid response in times of emergencies. On the other hand, privacy and regulatory terms are the major concerns on open approaches, following data reliability and legal restrictions of each country. The fear of sharing is also presented in all level of analysis, that is, individual level, organizational level and even nations level [2].

After this gathering of Open Science concerns and motivations, I leave some questions open in this paper, in order to be a starting point for future work:

- When sharing information, if the data has no demographic information or any type of identification associated with the individual, can it be shared without legal restrictions?
- How to ensure the reliability of shared data sources?
- Are countries prepared and encouraged to support this ‘open’ approach?

#### 4. Conclusion

This article focuses on Open Science aspects aligned with healthcare emergencies, motivated by the currently experienced pandemic. Three open approaches have been recognized, such as: Open Data providing an efficient and fast way to distribute important information; Open Access as an effective way to share and exchange scientific work; and Open Source by distributing resources according to the intended purpose.

Some benefits and concerns have been highlighted. Promote transparency in scientific research and in data sharing is one of the prestige levels to achieve [2]. Even as, another advantage of this methodology is also in preventing future outbreaks with early warnings. In this sequence, we believe that the adoption of Open Science in this pandemic time is crucial in improving health care, providing sharing data rapidly and widely.

However, legal restrictions, privacy and ethical issues are also needed to be reviewed. Some aspects are extremely important, such as the reliability of the data and its source. A reliable source must be essential in the

situation that we are living today. Therefore, new terms and new protocols, nationally and internationally, should be developed to avoid security problems and even plagiarism issues [3].

Overall, the objective of this study is to feed the discussion and provoke a future in-depth investigation in the adoption of Open Science standards or models, in order to help in the treatment and prevention of future pandemics. There must be more sharing but there must also be motivation to take advantage of this exchange of knowledge. The Covid-19 pandemic was the biggest epidemic in recent times, but it is yet another outbreak that feels the need to embrace this movement, which is Open Science.

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